



VALVULAR HEART DISEASE

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ADVANCED HEART FAILURE & TRANSPLANT

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Learning Objectives

- Recognize the pathophysiology and presentation of multiple valvular lesions, and select appropriate testing.
- Briefly discuss the indications for interventions for each lesion.

Valvular Regurgitation

- Mitral Regurgitation

- Acute
- Chronic

- Aortic Regurgitation

- Acute
- Chronic

- Tricuspid Regurgitation

- *pulmonary regurgitation → very rare*

A 74yo gentleman presents with abrupt dyspnea and orthopnea

- Hypotensive
- Tachycardic
- Rales
- Soft or no murmur
- TTE: hyperdynamic LV with mild MR

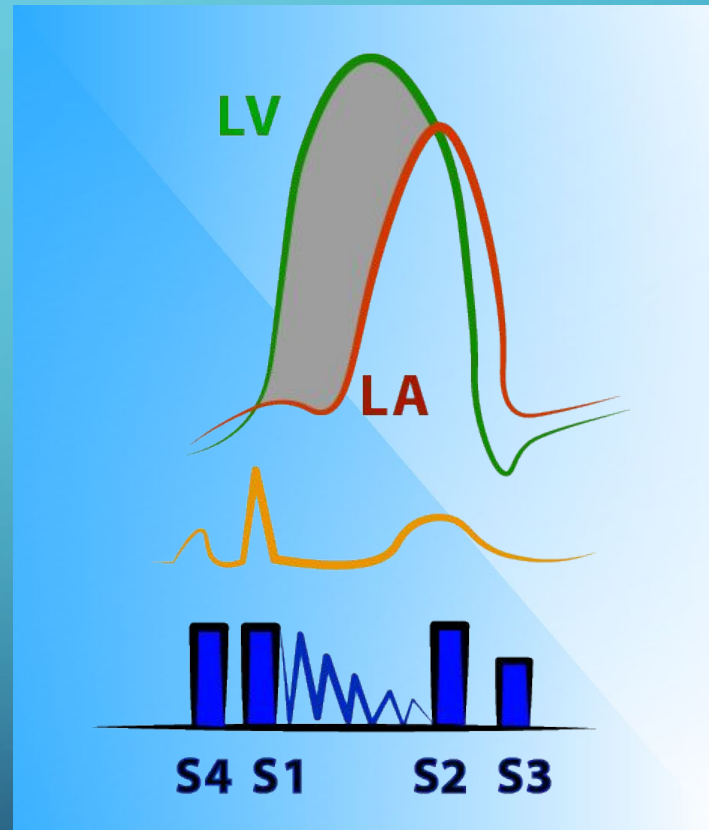
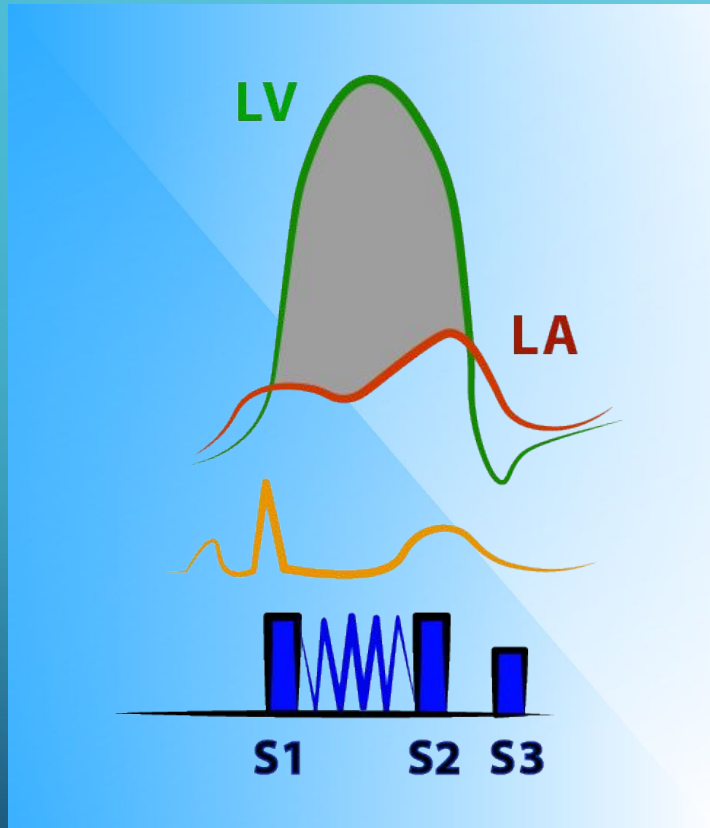
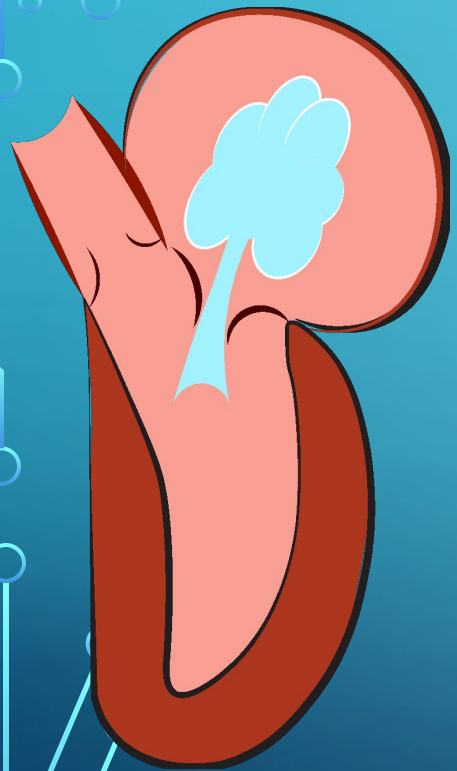


Acute Severe Mitral Regurgitation

A clinical syndrome

- Etiology (if TTE is negative, get TEE) → *trans thoracic echocardiogram*
 - Chordal rupture
 - Infective endocarditis
 - Ischemic heart disease
- Pulmonary congestion/edema
- S3 and S4
- MR murmur may be soft, short or absent

Hemodynamics of MR



Acute Severe Mitral Regurgitation

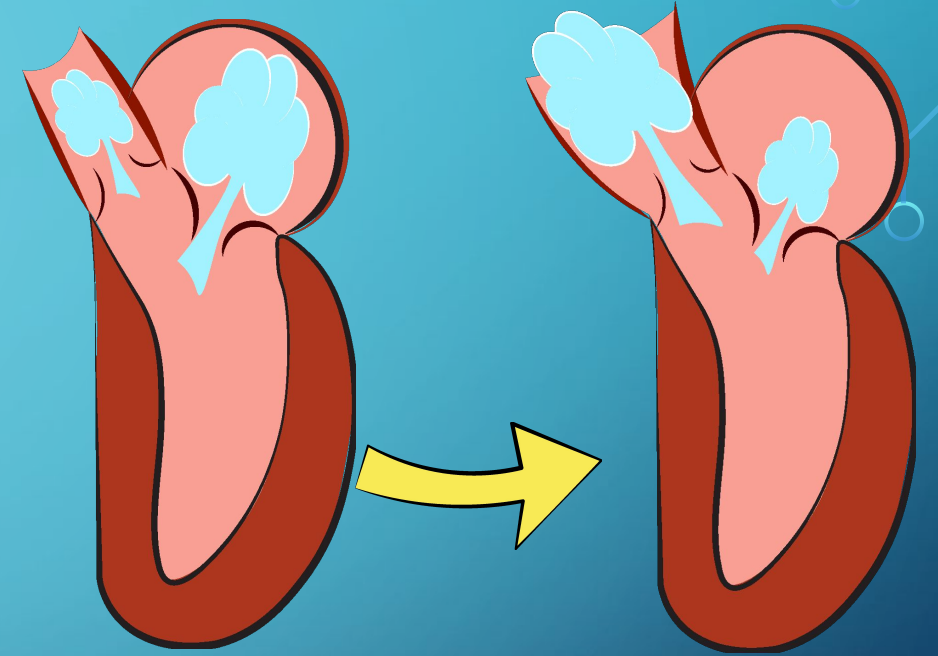
Treatment

- Treat with **afterload reduction** (vasodilators, IABP)

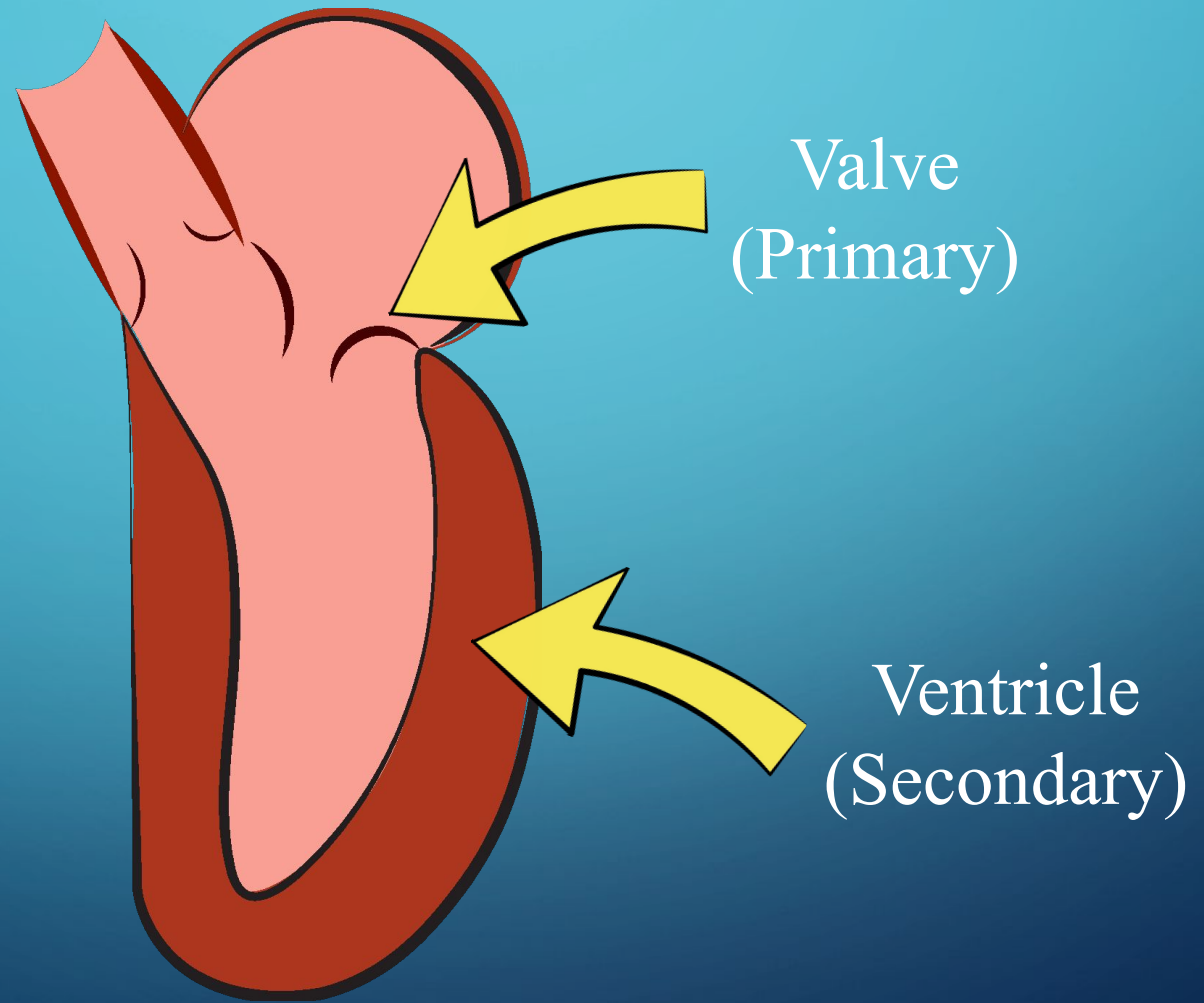
↳ ↑ forward flow & ↓ backward flow

- Surgery – dictated by etiology

- Papillary muscle rupture, dehisced mitral prosthesis: operate NOW
- Endocarditis: operate if heart failure
- Chordal rupture: depends on response to therapy



Chronic Mitral Regurgitation

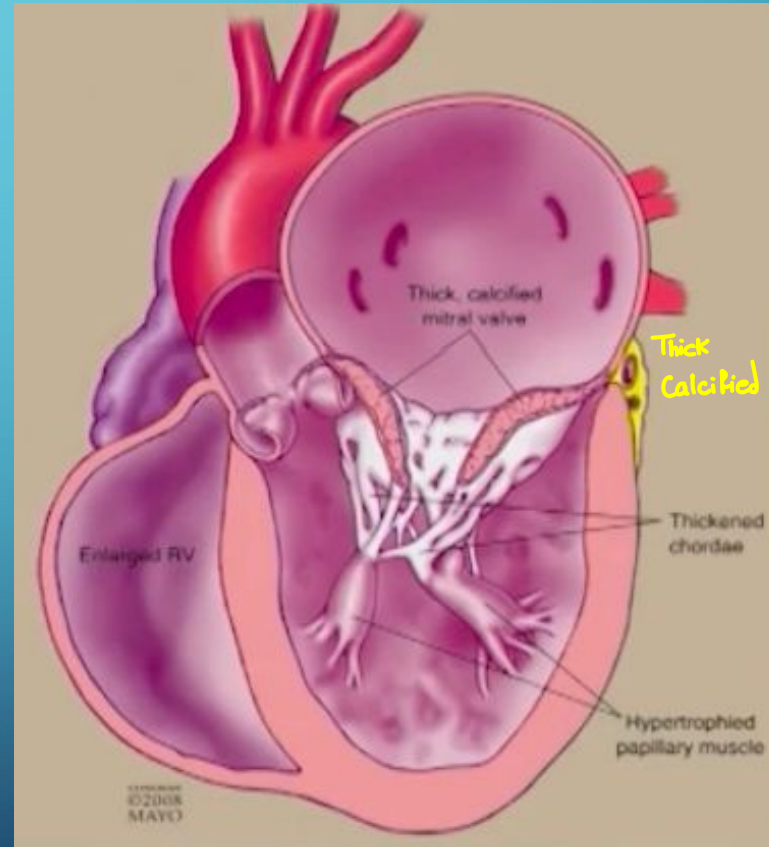
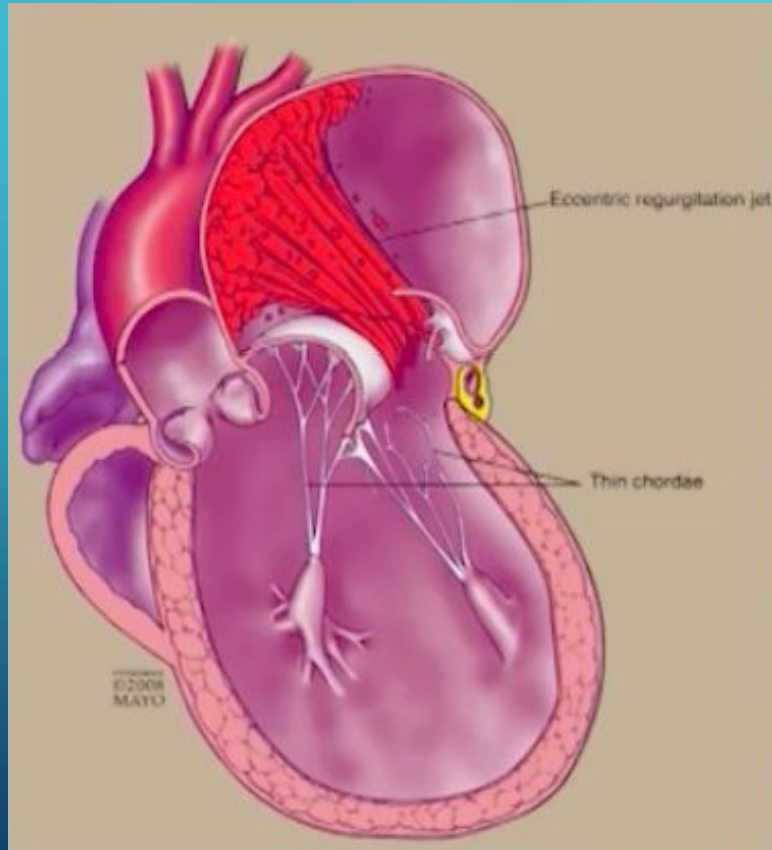


Primary Chronic MR

- Primary MR caused by **mitral valve prolapse**
 - Also called degenerative or myxomatous
- Billowing of mitral valve leaflets above annulus
- Common cause of **mitral regurgitation**
- Causes a **systolic click**
 - Don't confuse with opening snap of mitral stenosis

Degenerative

Rheumatic

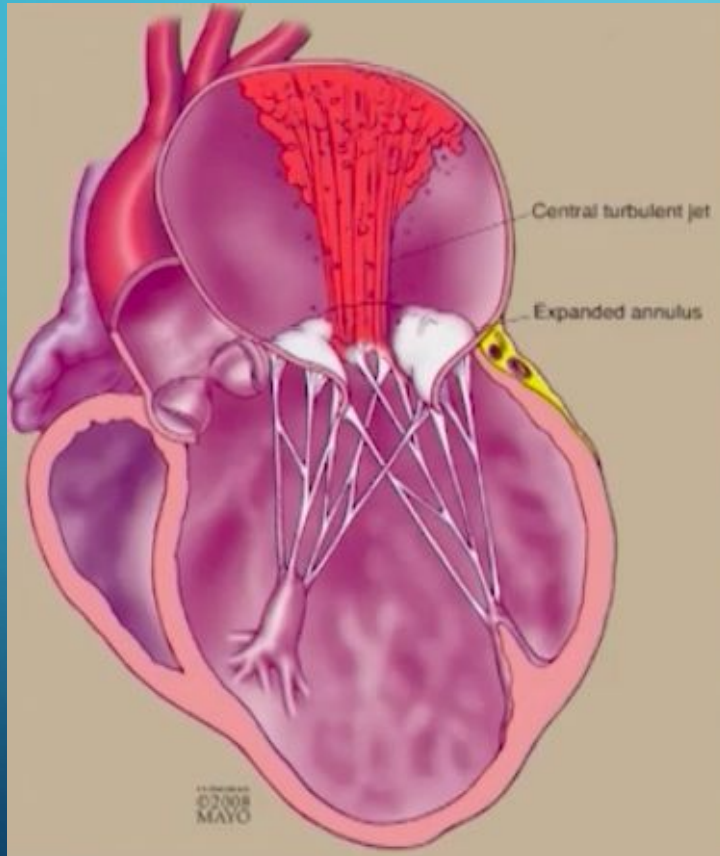


Mitral valve prolapse

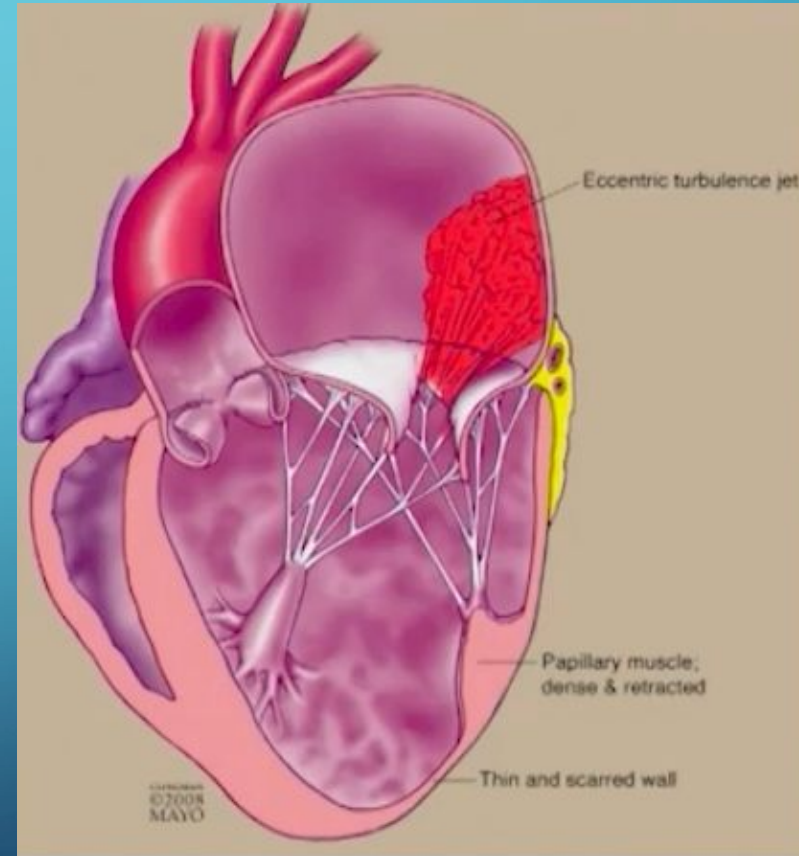
Secondary Chronic MR

- Ischemia → damage to papillary muscle
- Left ventricular dilation
 - Dilated cardiomyopathy ← can't function
 - Leaflets pulled apart ← less of
 - **"Functional" MR** nothing wrong with the valve
- Hypertrophic cardiomyopathy

Dilated



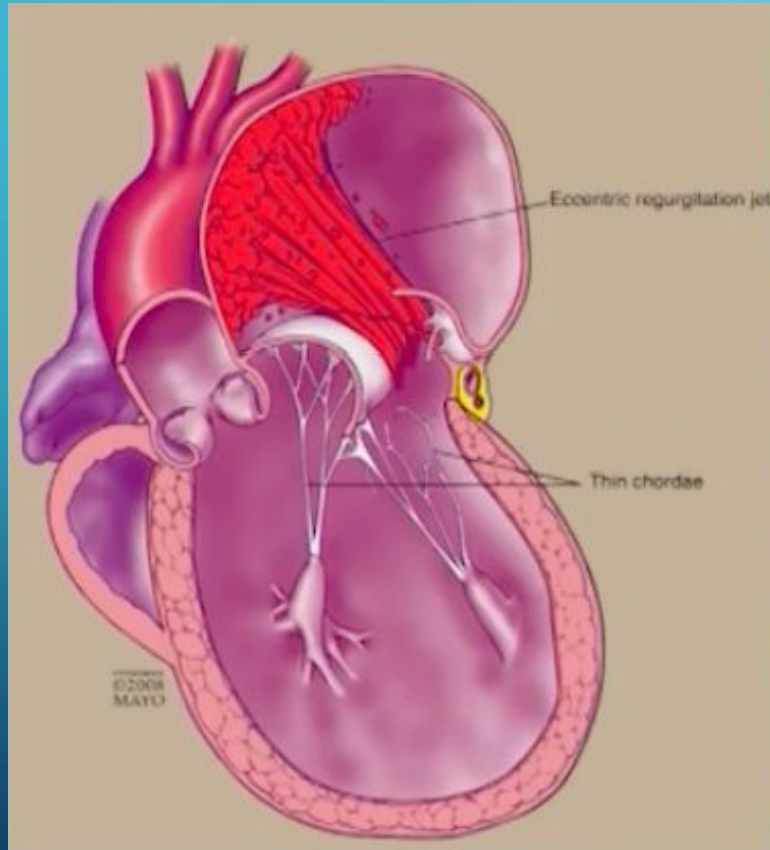
Ischemic



Primary Chronic MR

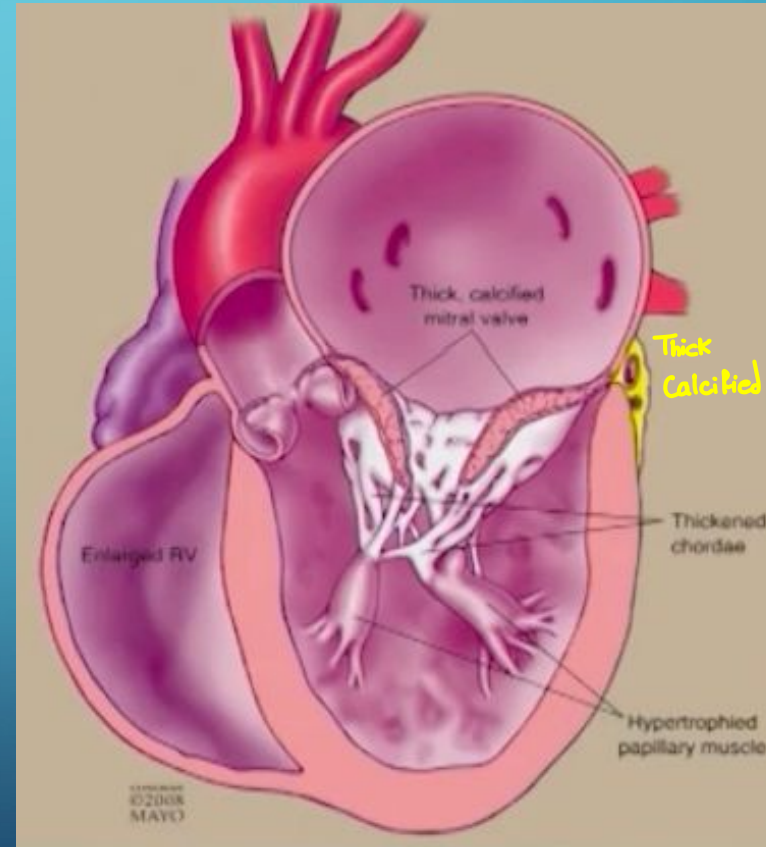
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Degenerative



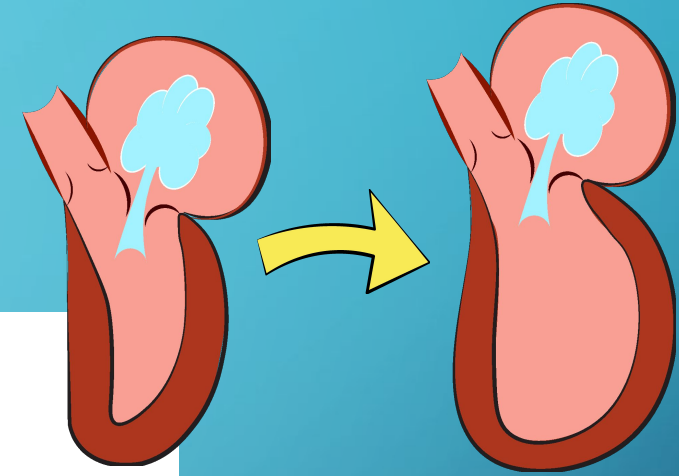
Mitral valve prolapse

Rheumatic

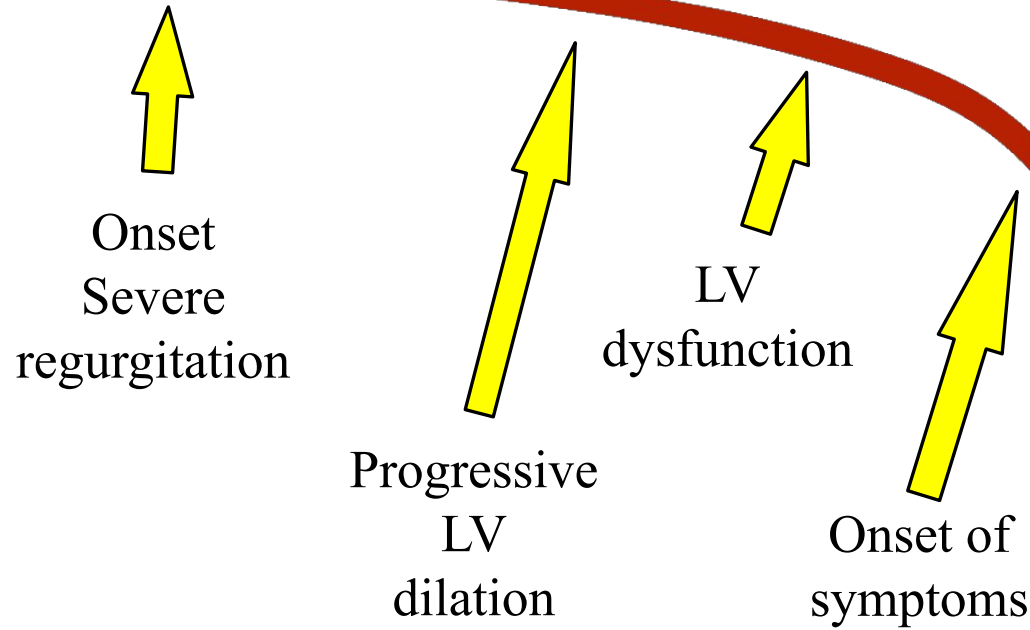


Regurgitant Lesions

Concept of volume overload



Survival

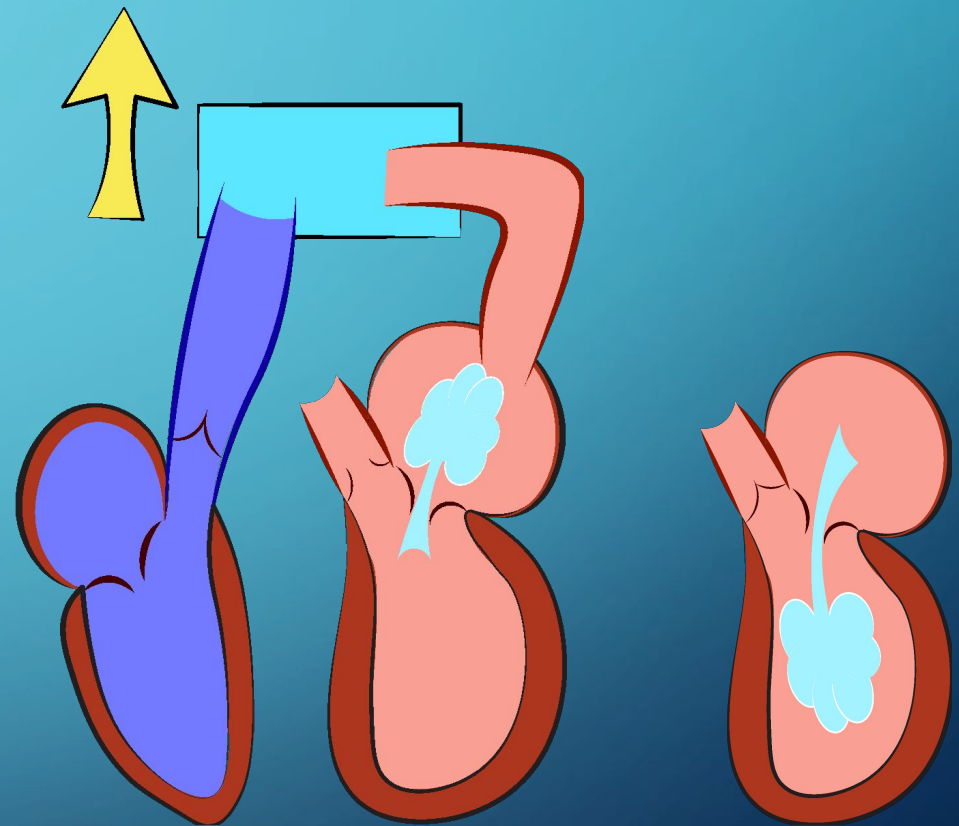
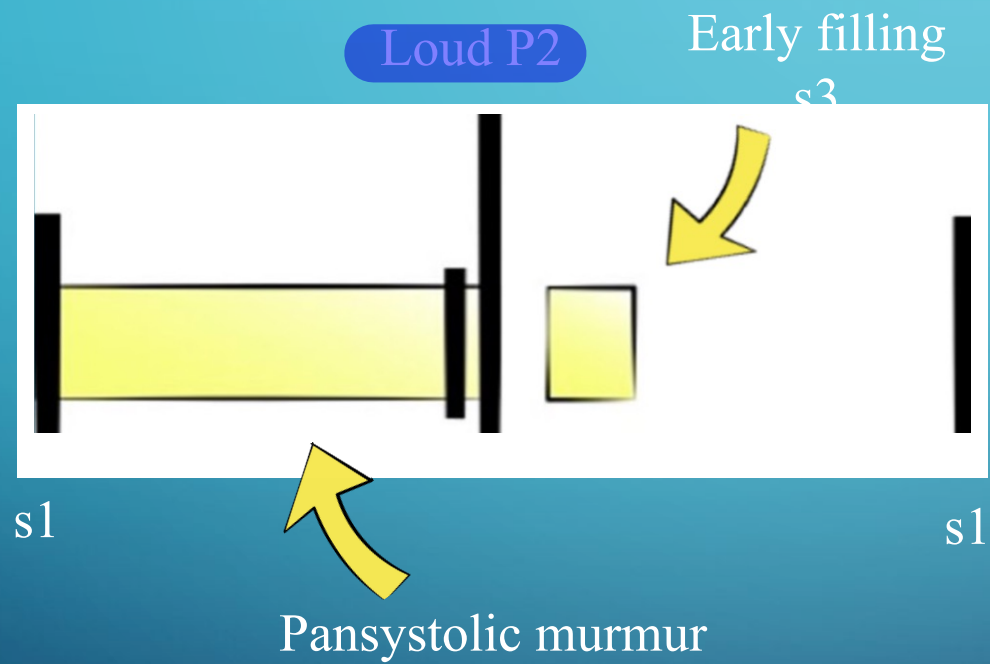


- Prolonged asymptomatic period
- Low output, pulmonary congestion

Years

Chronic MR

Physical Examination



Chronic MR

How to assess?



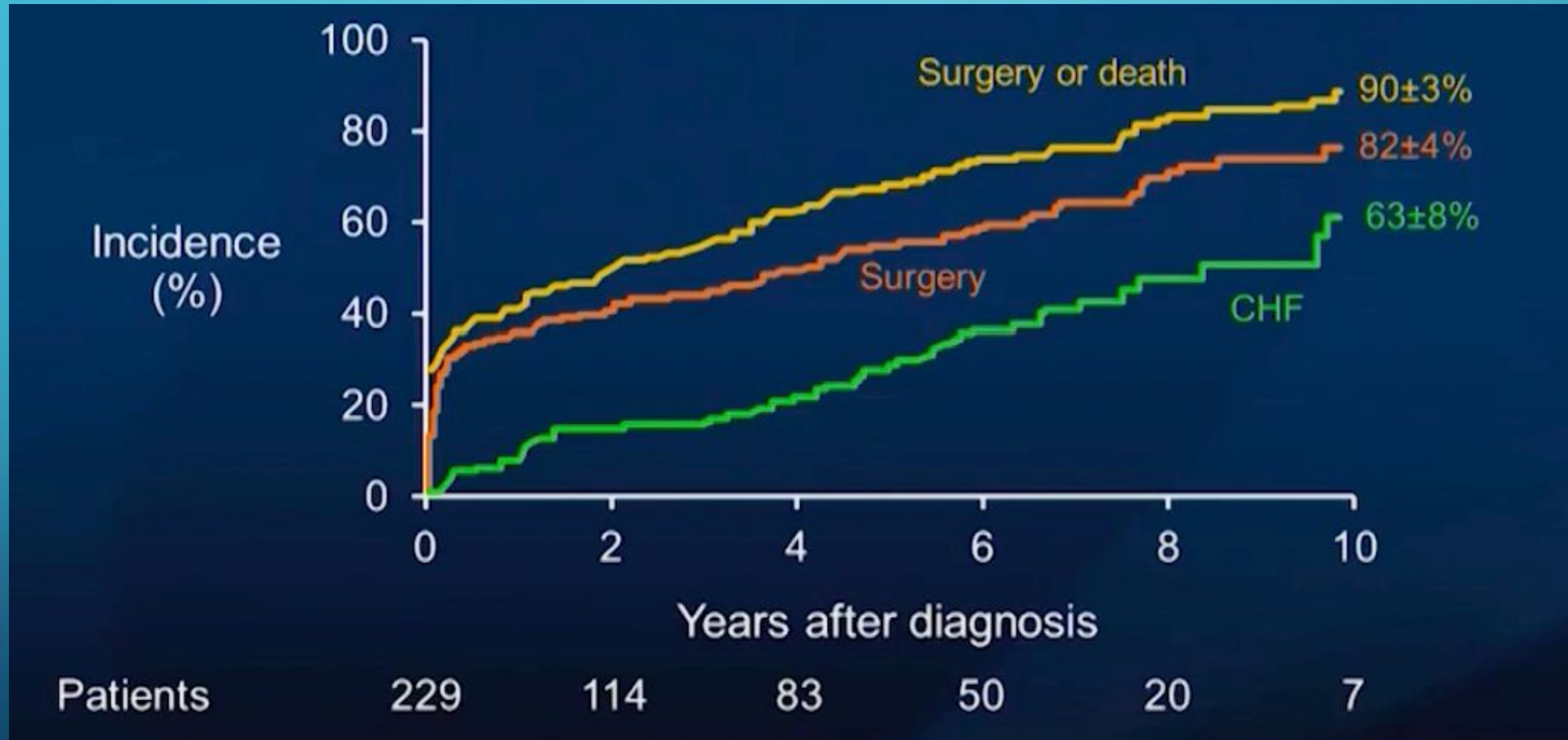
Chronic MR

Echocardiography

- The severity of the regurgitation
- The etiology (flail leaflets, degenerative disease, secondary MR, MVP)
- Evaluation of anatomy for intervention

Chronic primary MR

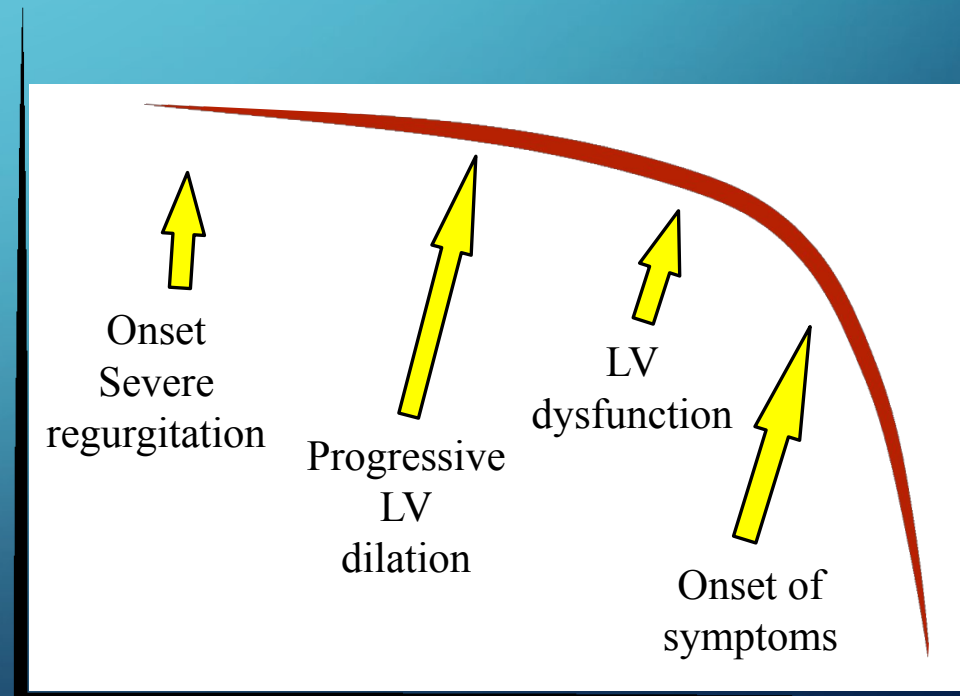
Treatment



Chronic primary MR

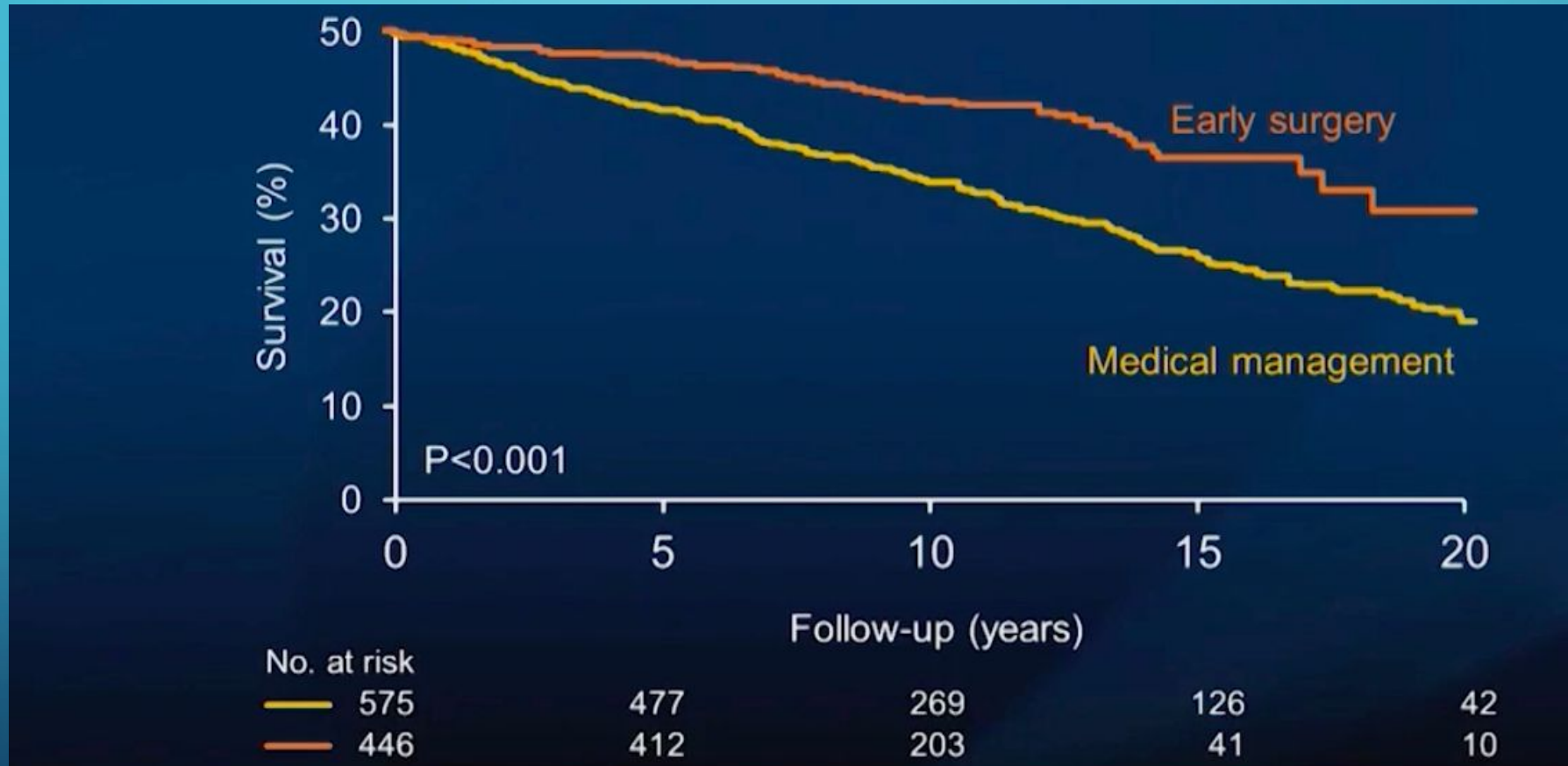
Treatment

- In the absence of systemic hypertension, **no indication** for vasodilator therapy if asymptomatic and preserved LV.
- Indications for surgery (MVR or repair):
 - Severe MR
 - Any symptoms of HF
 - LV dysfunction (EF <60%)
 - LV dilation



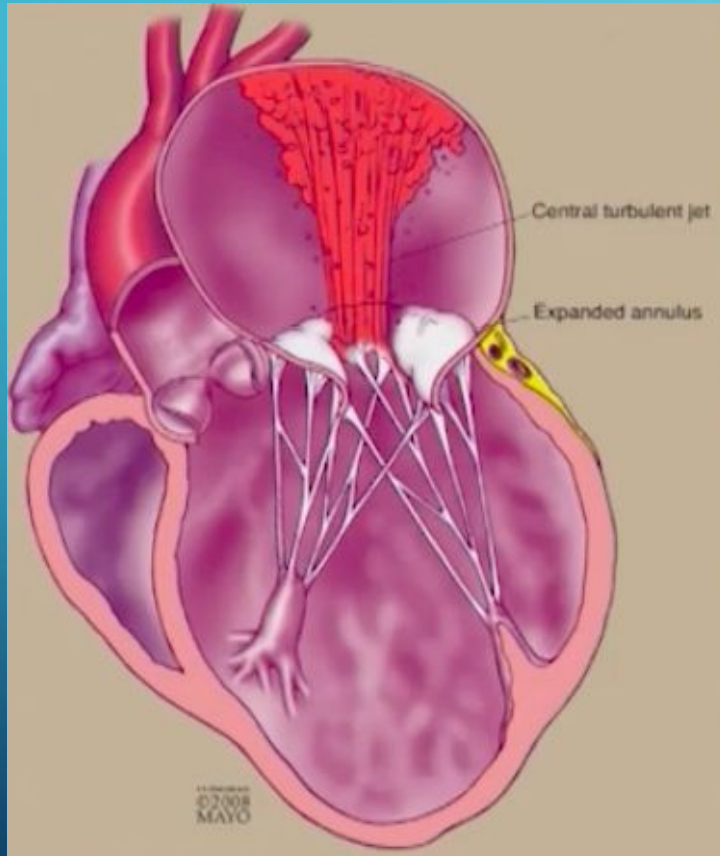
Chronic primary MR

Treatment

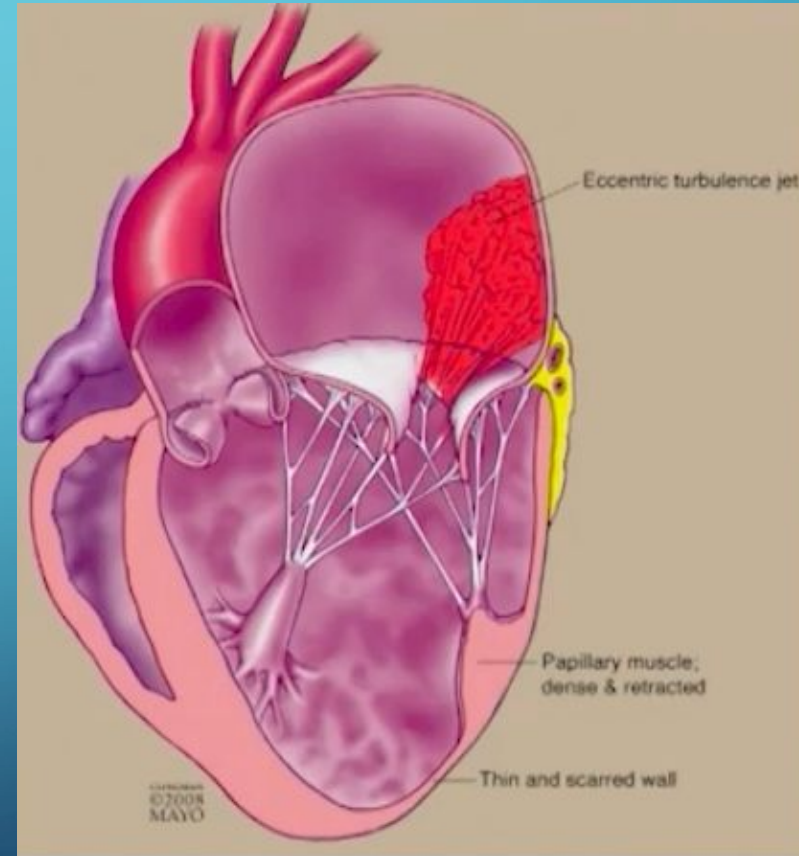


Secondary Chronic MR

Dilated

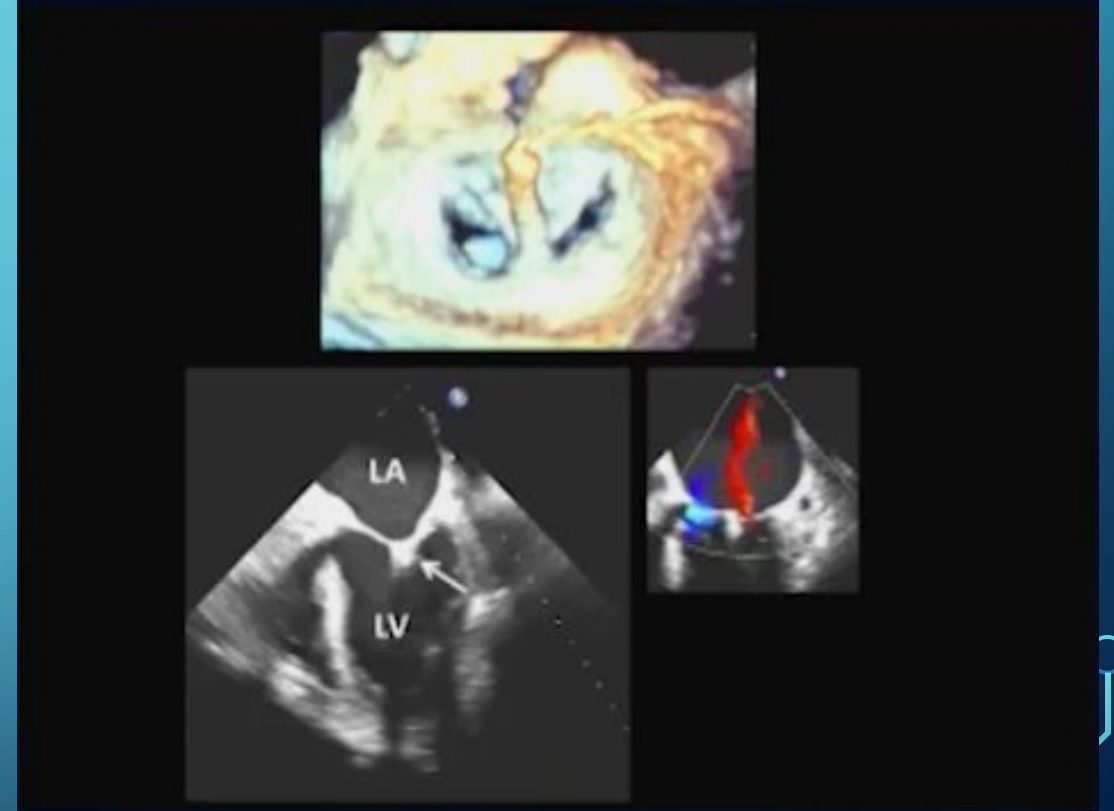


Ischemic



Chronic secondary MR

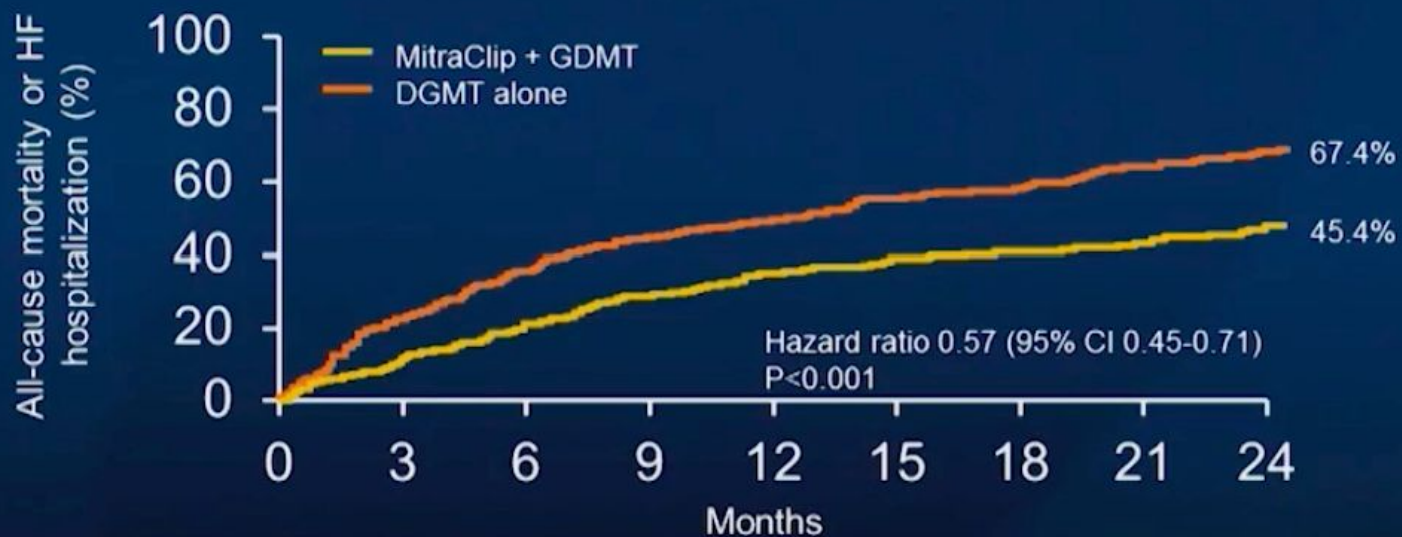
Treatment (Percutaneous Mitra-Clip)



Chronic secondary MR

Treatment

COAPT Trial



No. at risk	0	3	6	9	12	15	18	21	24
MitraClip + GDMT	302	264	238	215	194	154	145	126	97
DGMT alone	312	244	205	174	153	117	90	75	55

Chronic secondary MR

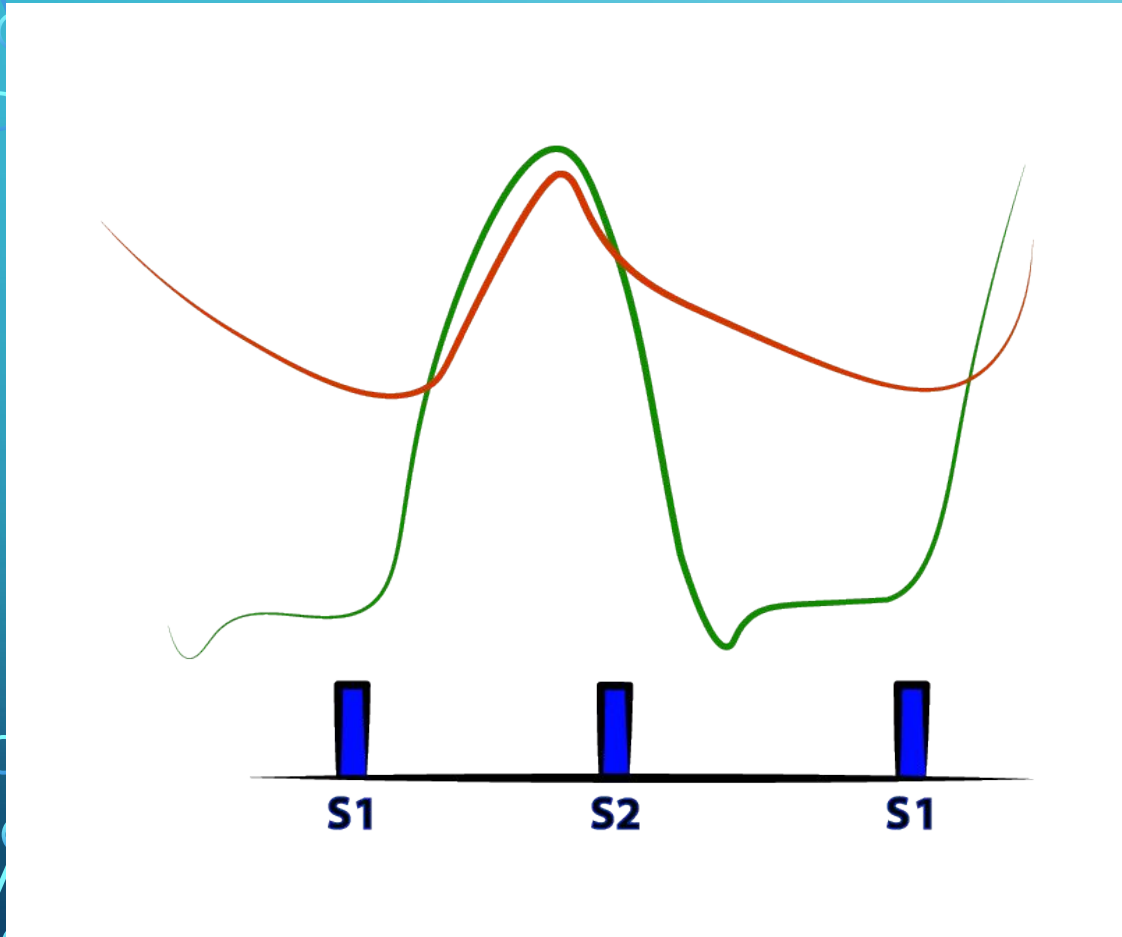
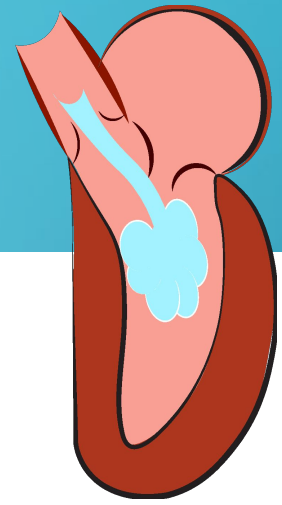
Treatment

- Treatment of chronic HF with guideline-directed medical therapy
- Treatment of ongoing ischemia if any
- If ongoing symptoms with severe MR, consider treatment with percutaneous Mitra-Clip

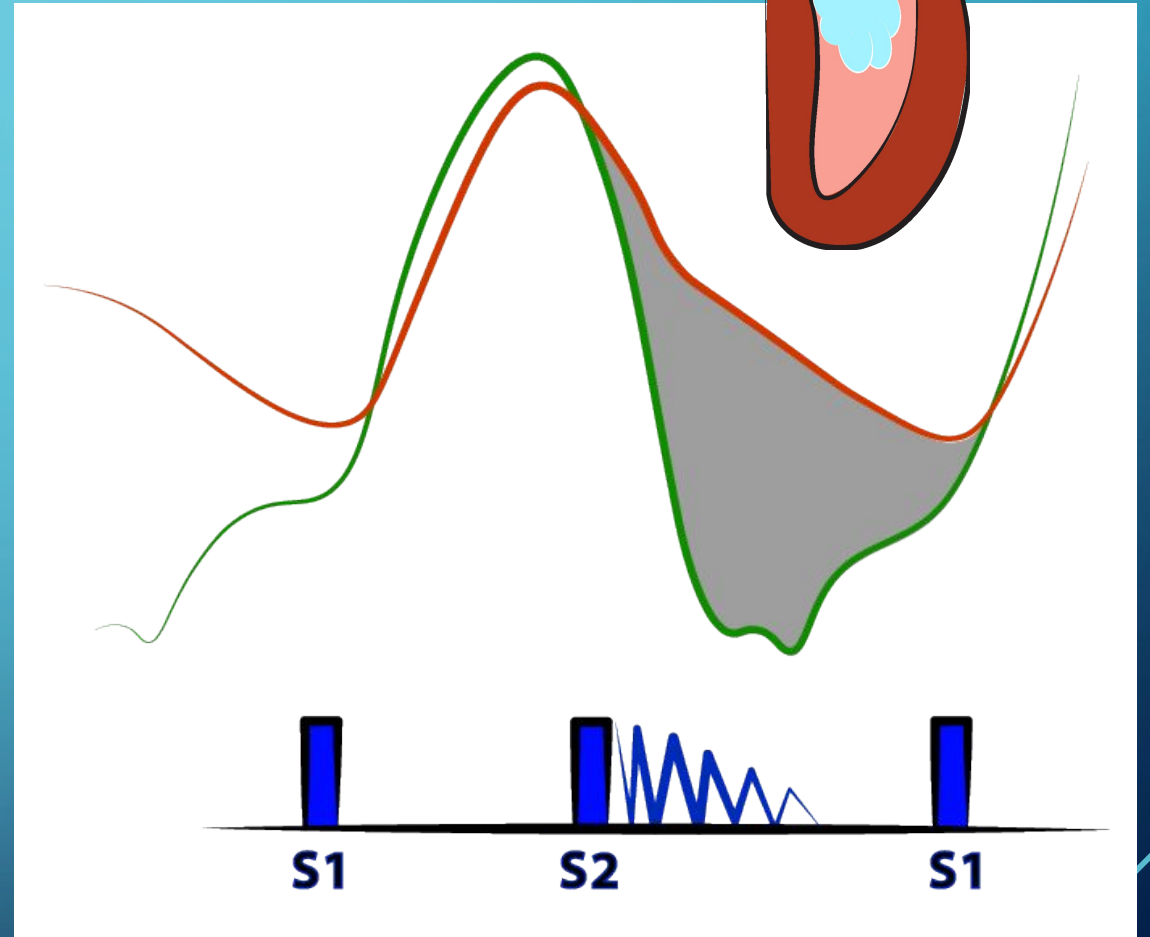
Aortic Regurgitation

- Acute aortic regurgitation
- Chronic aortic regurgitation
 - **Dilated aortic root** → leaflets pull apart
 - Often from HTN or other aortic aneurysm
 - Rarely from tertiary syphilis (aortitis)
 - **Bicuspid aortic valve**
 - Turner syndrome
 - Coarctation of the aorta
 - Endocarditis
 - Rheumatic heart disease
 - Almost always with mitral disease

Acute Aortic Regurgitation



Normal Hemodynamics



Acute AR

Acute Aortic Regurgitation

A clinical syndrome

transthoracic echocardiogram

- Etiology (if TTE is negative, get TEE)

transesophageal echocardiogram

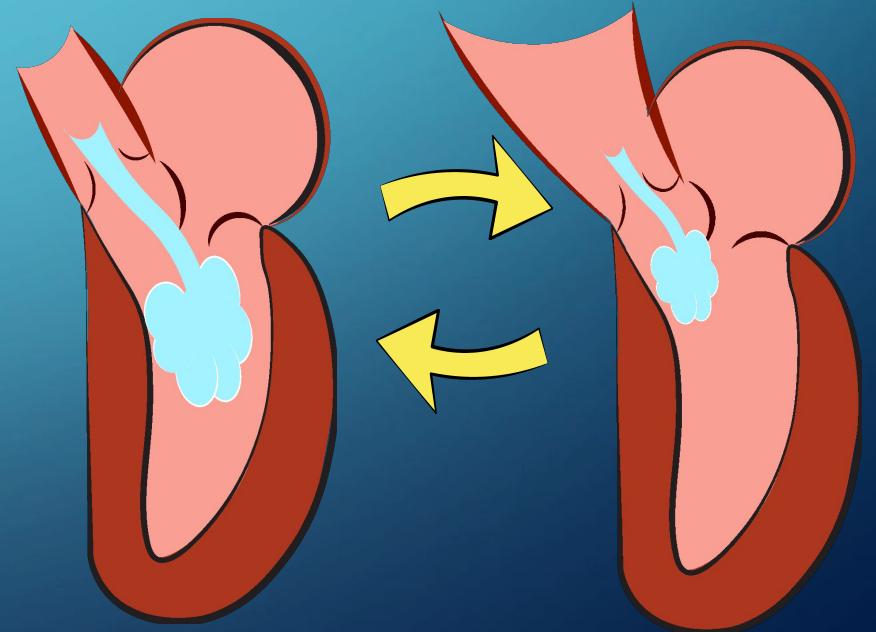
- Root - dissection
- Valve - endocarditis
- Pulmonary congestion/edema
- S3 and S4
- AR murmur may be soft, short or absent
- May not have bounding pulse

↳ Enemy of aortic regurgitation is
bradycardia

Acute Severe Aortic Regurgitation

Treatment Options

- Urgent surgical intervention indicated
- Afterload enhancers **contraindicated** (pressors)
- Afterload reducers can be used
- Beta blockers **contraindicated**
- Inotropic support can be used
- May not have bounding pulse



Aortic Regurgitation

Etiologies

Intrinsic Valvular

- Degenerative/calcific
- Bicuspid
- Endocarditis
- Rheumatic fever
- Valvulitis
- Anorexia medications

Ascending Aortic

- Degenerative
- Type A dissection
- Marfan syndrome
- Inflammatory
- Giant cell arteritis

Aortic Regurgitation

Physical examination

- The most consistent exam finding: wide pulse pressure
- Head nodding (de Musset's)
- Capillary pulsation (Quincke's)
- Rapid carotid upstroke, rapid collapse (Corrigan's pulse)
- "Pistol Shot" femoral (Duroziez's)

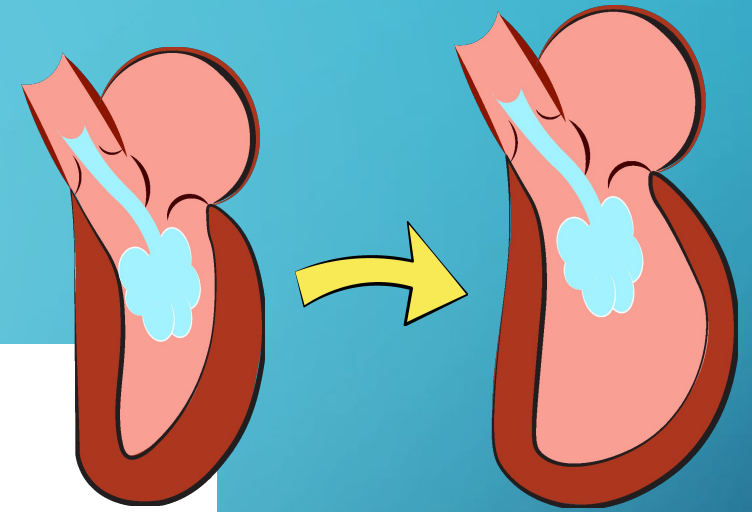


Aortic Regurgitation Diagnosis

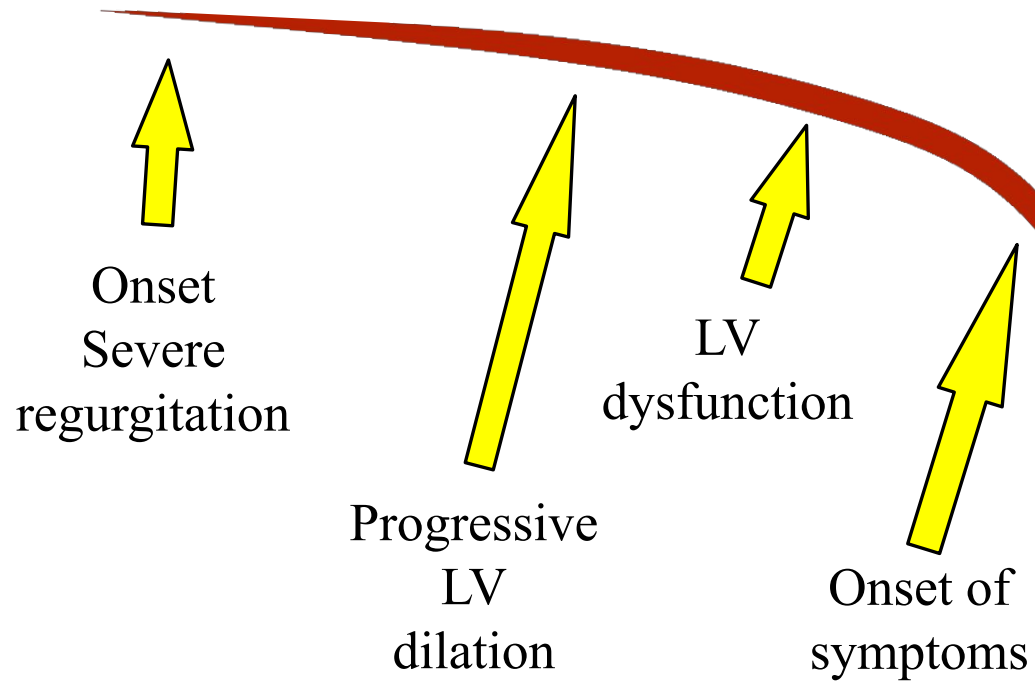


Chronic Aortic Regurgitation

Concept of volume and pressure overload



Survival

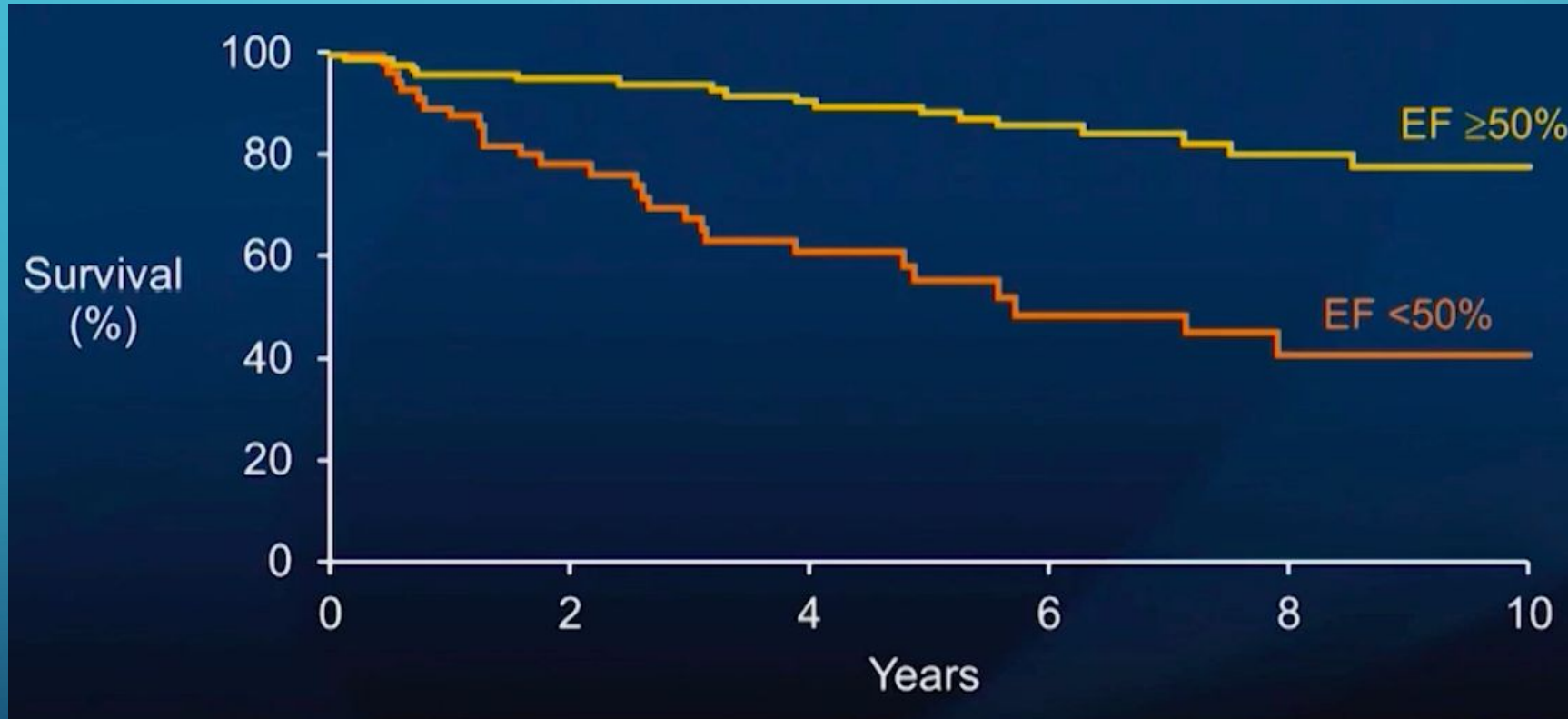


- Prolonged asymptomatic period
- Low output, pulmonary congestion

Years

Chronic Aortic Regurgitation

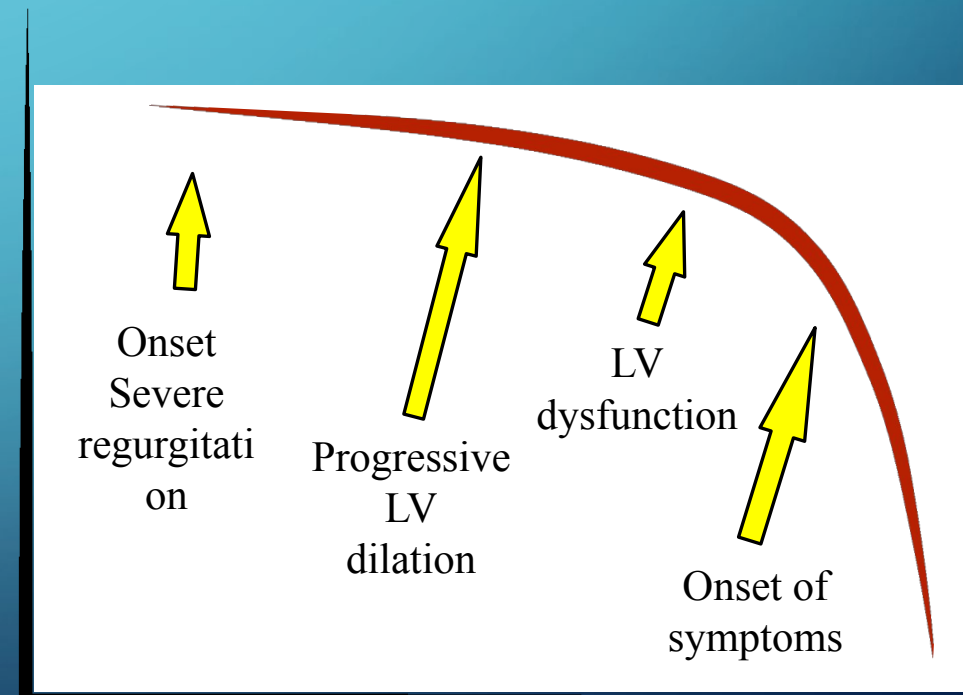
Natural History: LV function



Chronic severe aortic regurgitation

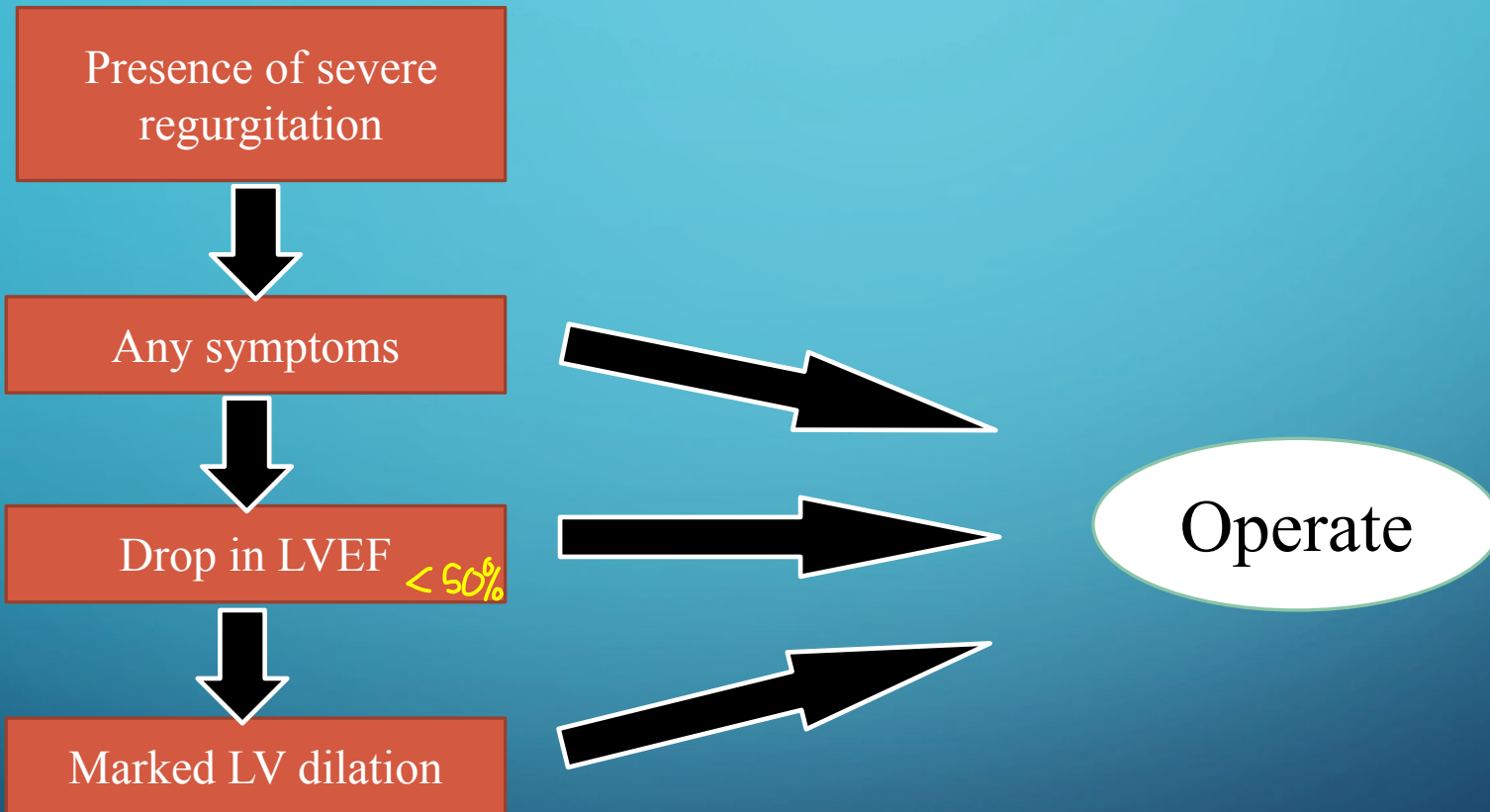
Treatment

- In the absence of systemic hypertension, **no indication** for vasodilator therapy if asymptomatic and preserved LV.
- Indications for surgery (AVR):
 - Severe AR
 - Any symptoms of HF
 - LV dysfunction (EF <50%)
 - LV dilation



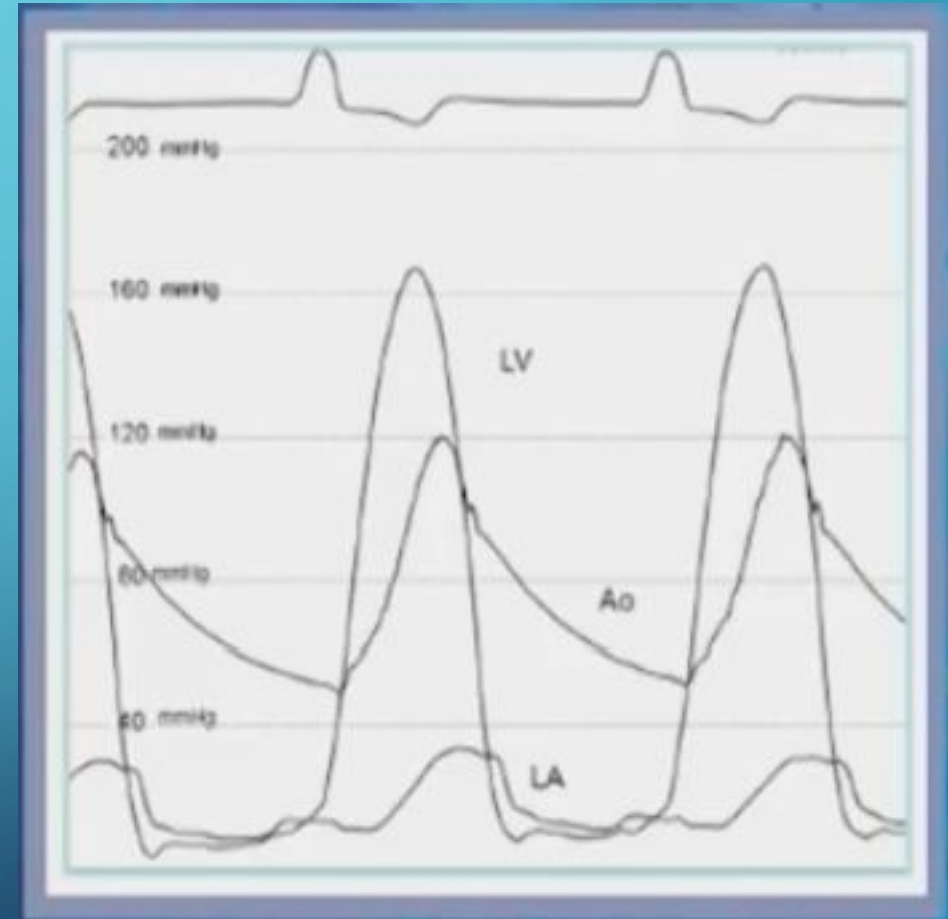
Valvular Regurgitation

Indications for operation



In this patient with a systolic murmur and $EF = 62\%$, what is the major pathophysiologic abnormality?

1. Increased wall stress, increased preload ✓
2. ✗ Decreased afterload, decreased preload
3. Decreased wall stress, increased preload
4. Increased afterload, normal preload ✗



Aortic Stenosis

Locations

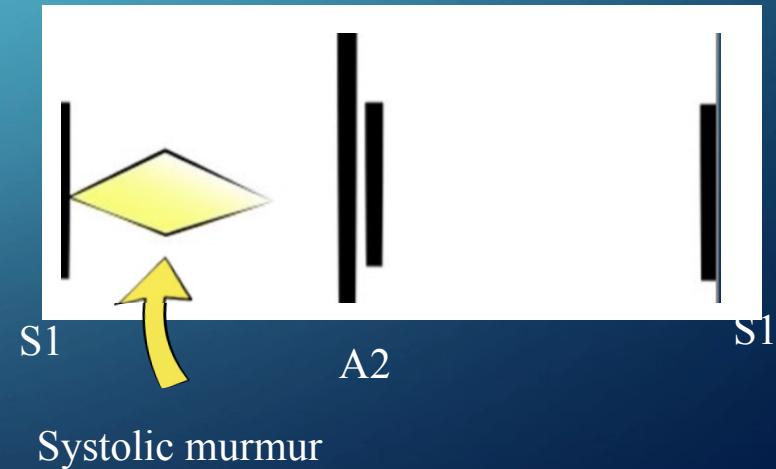
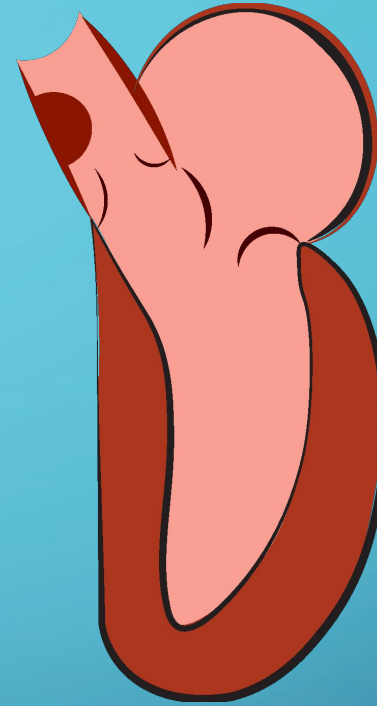
- Supravalvular
- Subvalvular
- Valvular



Aortic Stenosis

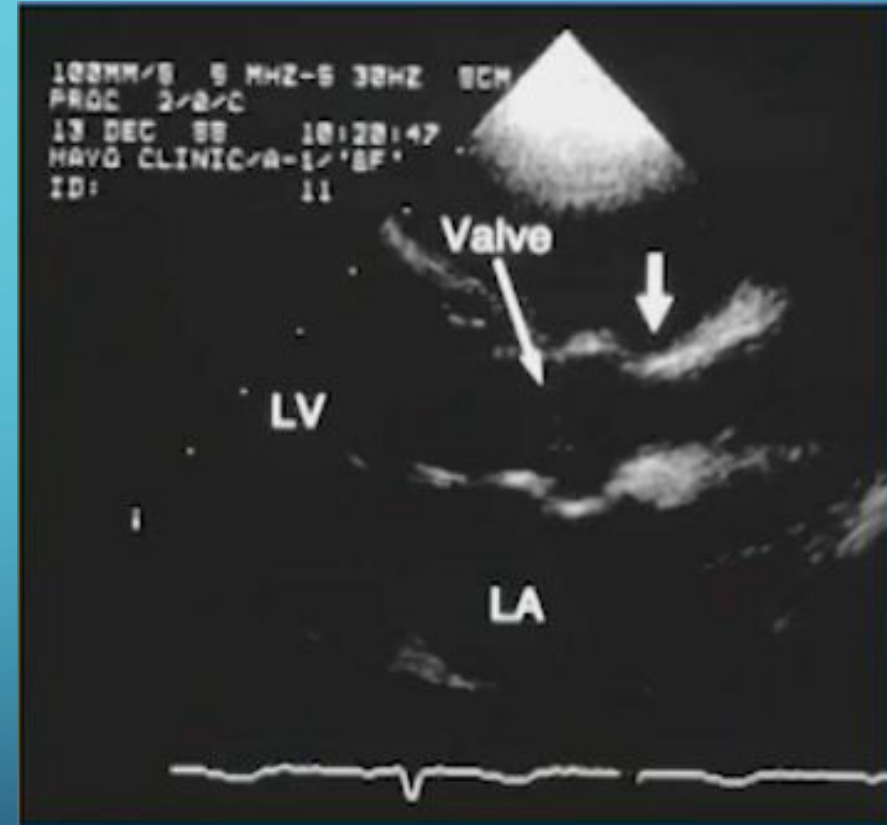
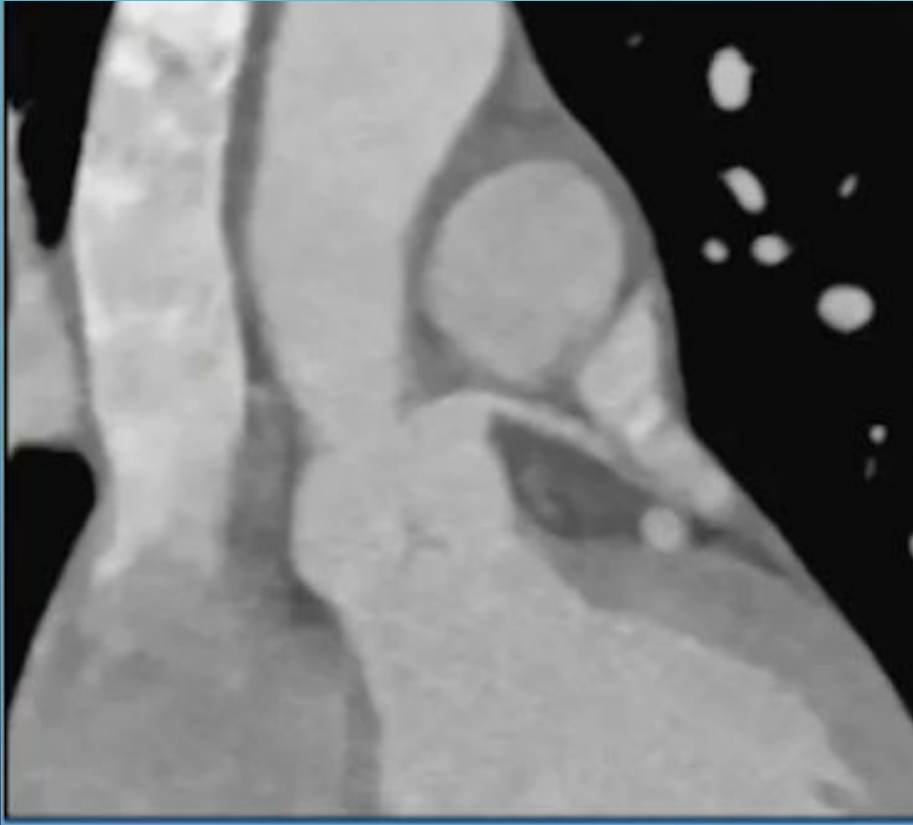
Supravalvular stenosis

- Level of obstruction: Aorta
 - Single discrete narrowing
 - Long tubular hypoplasia
- Physical Examination
 - Thrill in suprasternal notch or R carotid
 - Loud A2
 - Systolic murmur over the aortic area



Aortic Stenosis

Supravalvular stenosis



Surgical treatment: may need conduit if severe

Aortic Stenosis

Subvalvular stenosis

- Seen in 10% of patients with AS
 - Discrete ridge
 - Tunnel stenosis
 - Frequently accompanied by AR due to jet on aortic valve



Aortic Stenosis

Subvalvular stenosis

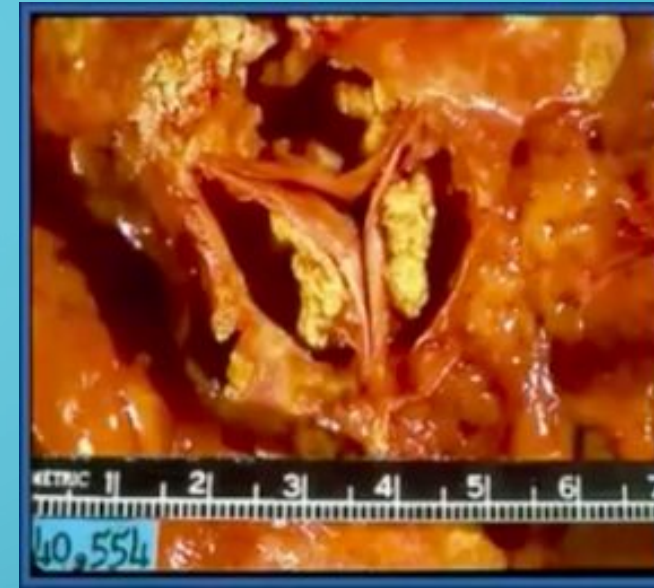
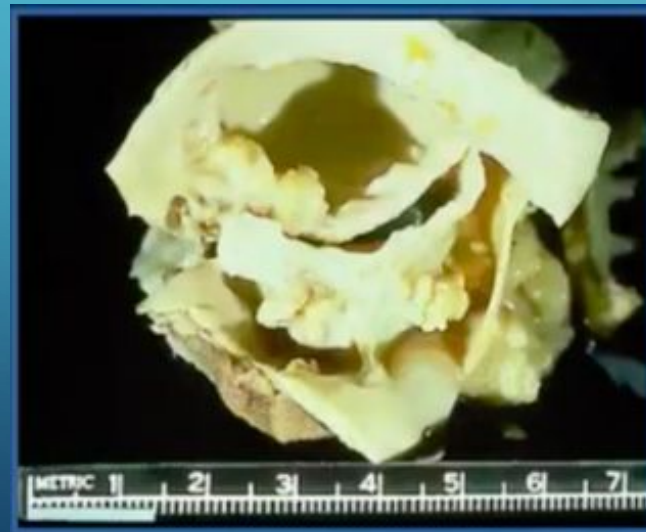
- **Diagnosis**
 - Echocardiography (TTE or TEE)
- **Treatment**
 - Surgical resection especially if severe or there is AR progression



Aortic Stenosis

valvular stenosis

- Age related
 - <30: congenital (unicuspid, bicuspid)
 - 40-60: calcified bicuspid
 - 40-60: rheumatic
 - >70: senile degenerative (the most common of all)

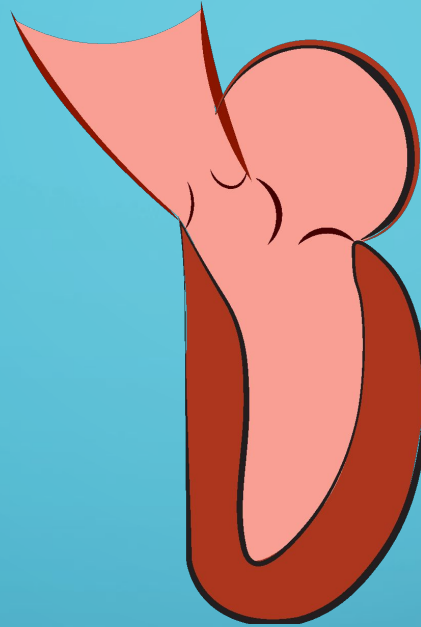


Aortic Stenosis

Bicuspid Valve



Bicuspid Valve



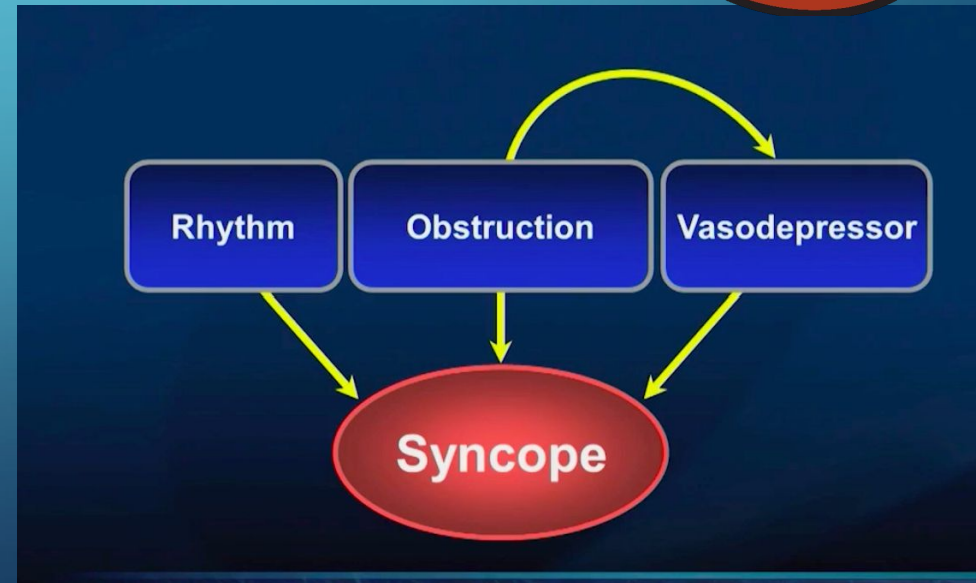
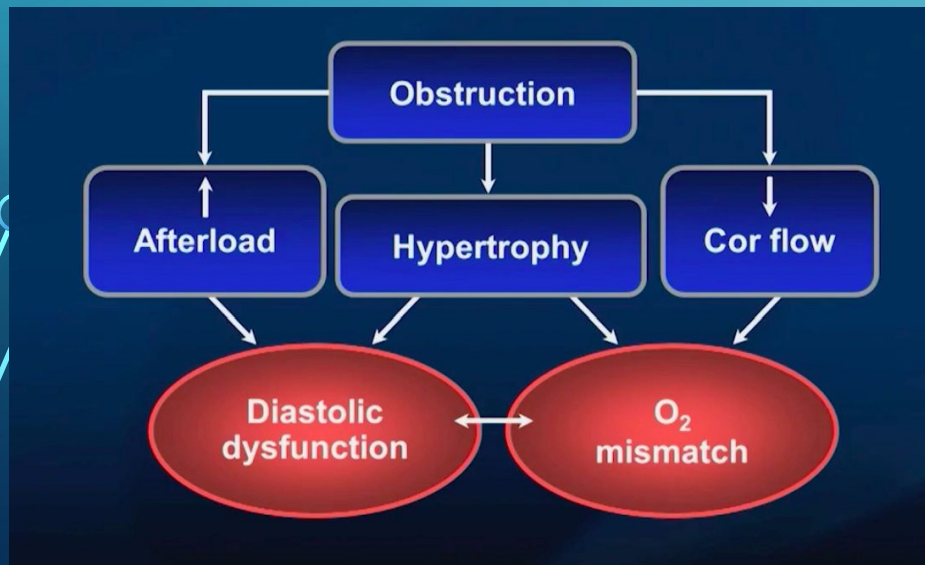
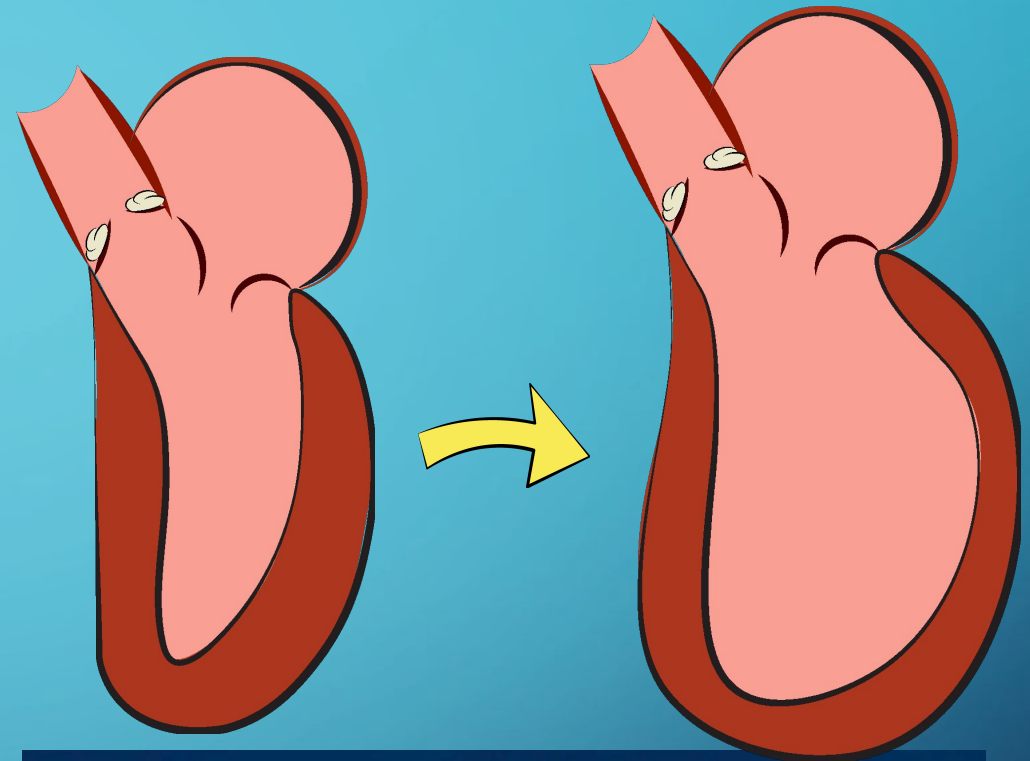
Aortic Medial Changes

- Screen first degree relatives
- Scan entire aorta

Aortic Stenosis

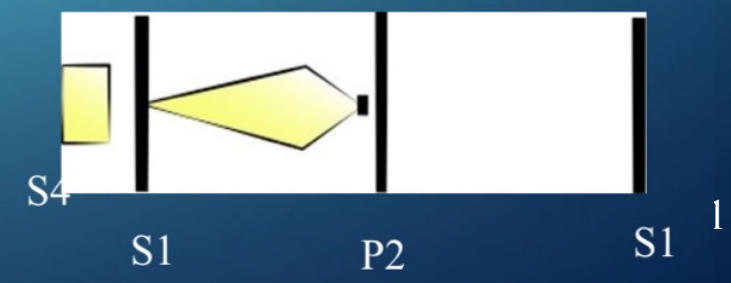
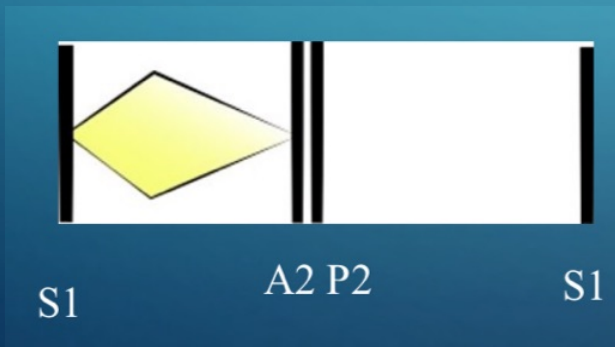
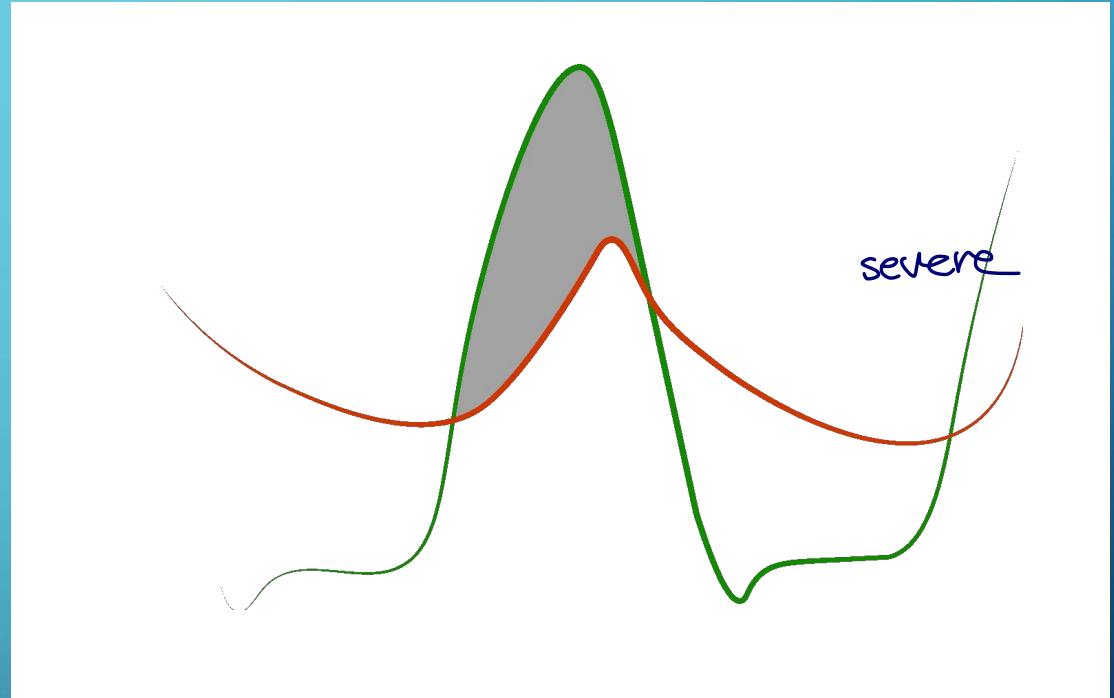
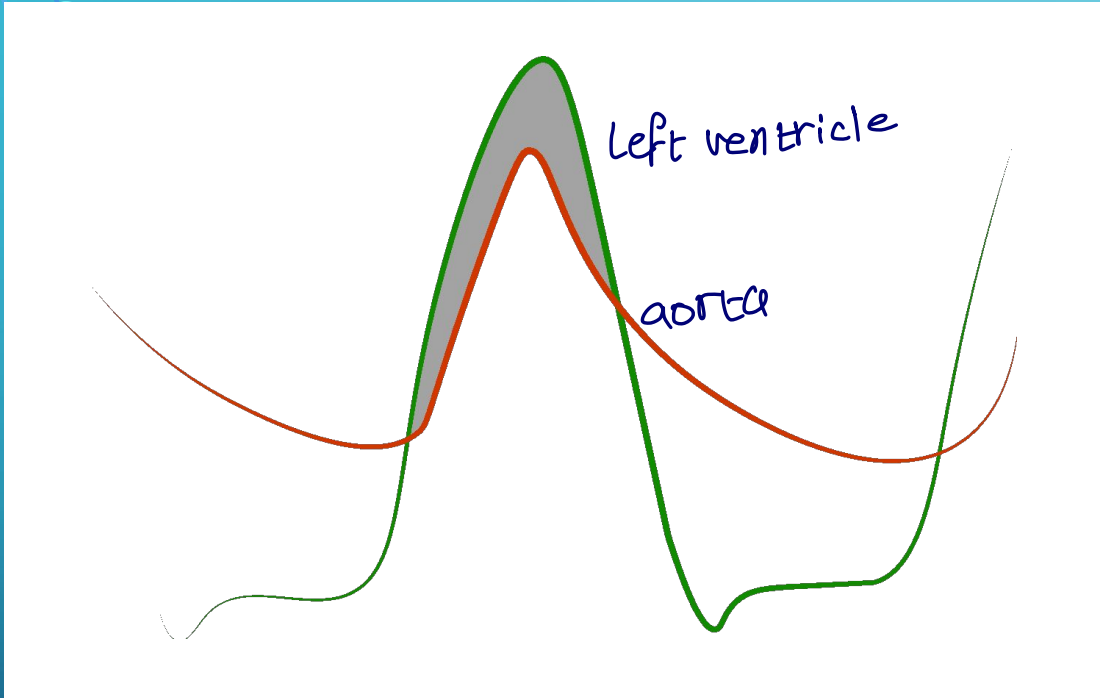
Hemodynamics

- The law of Laplace
 - $T = r * p / 2h$
 - Wall tension
 - radius
 - pressure
 - Wall thickness
- Initial normalization of stress
- End-stage, regression of LVEF
- Symptoms:
 - Dyspnea, angina, syncope



Aortic Stenosis

Physical Examination



Aortic Stenosis Diagnosis



↳ signs of severe aortic stenosis: 1. Late peaking systolic murmur

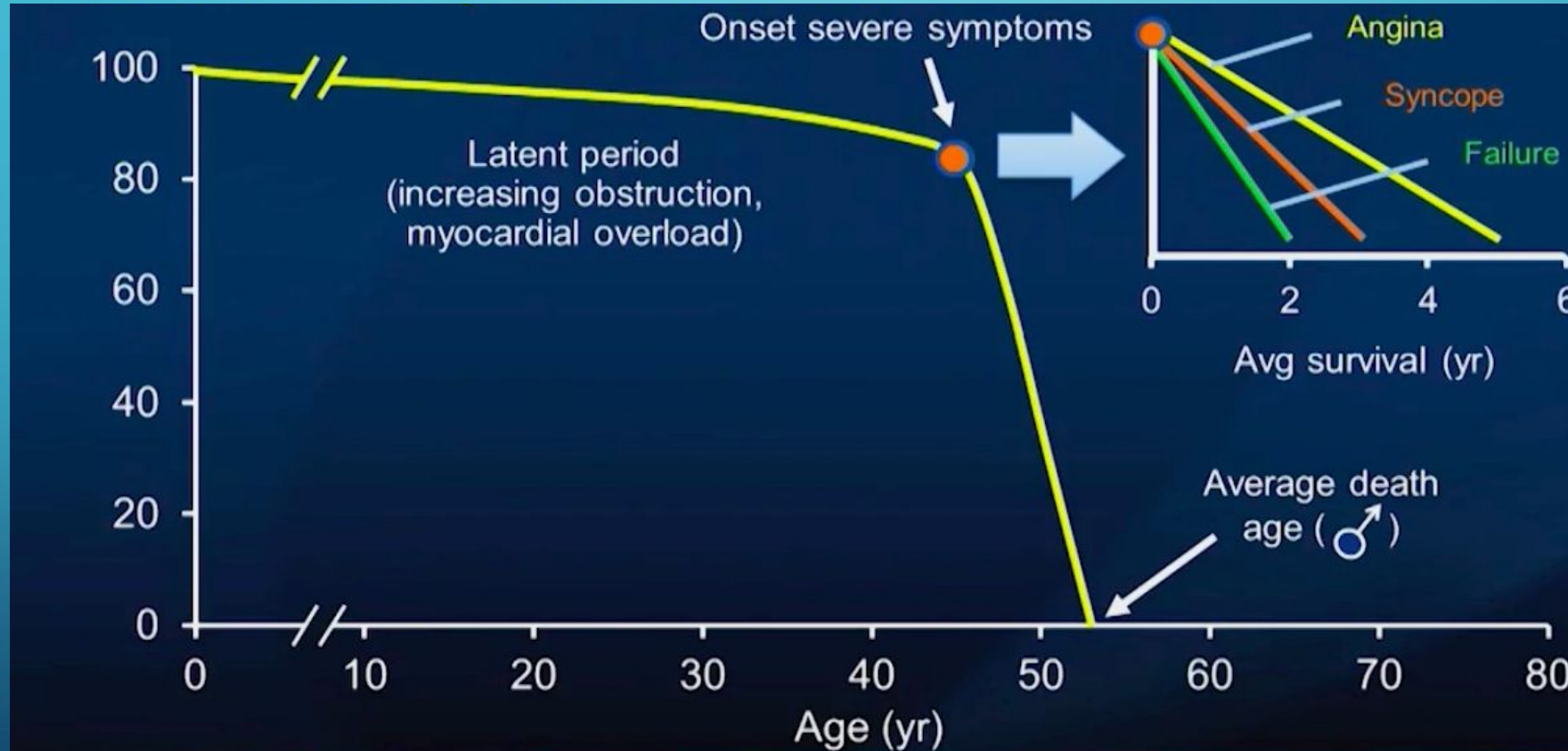
2. single S2

١- aortic valve حمار يتأخر كثير بحيث إنه هو

وال pulmonary valve حماروا يسكروا مع بعض

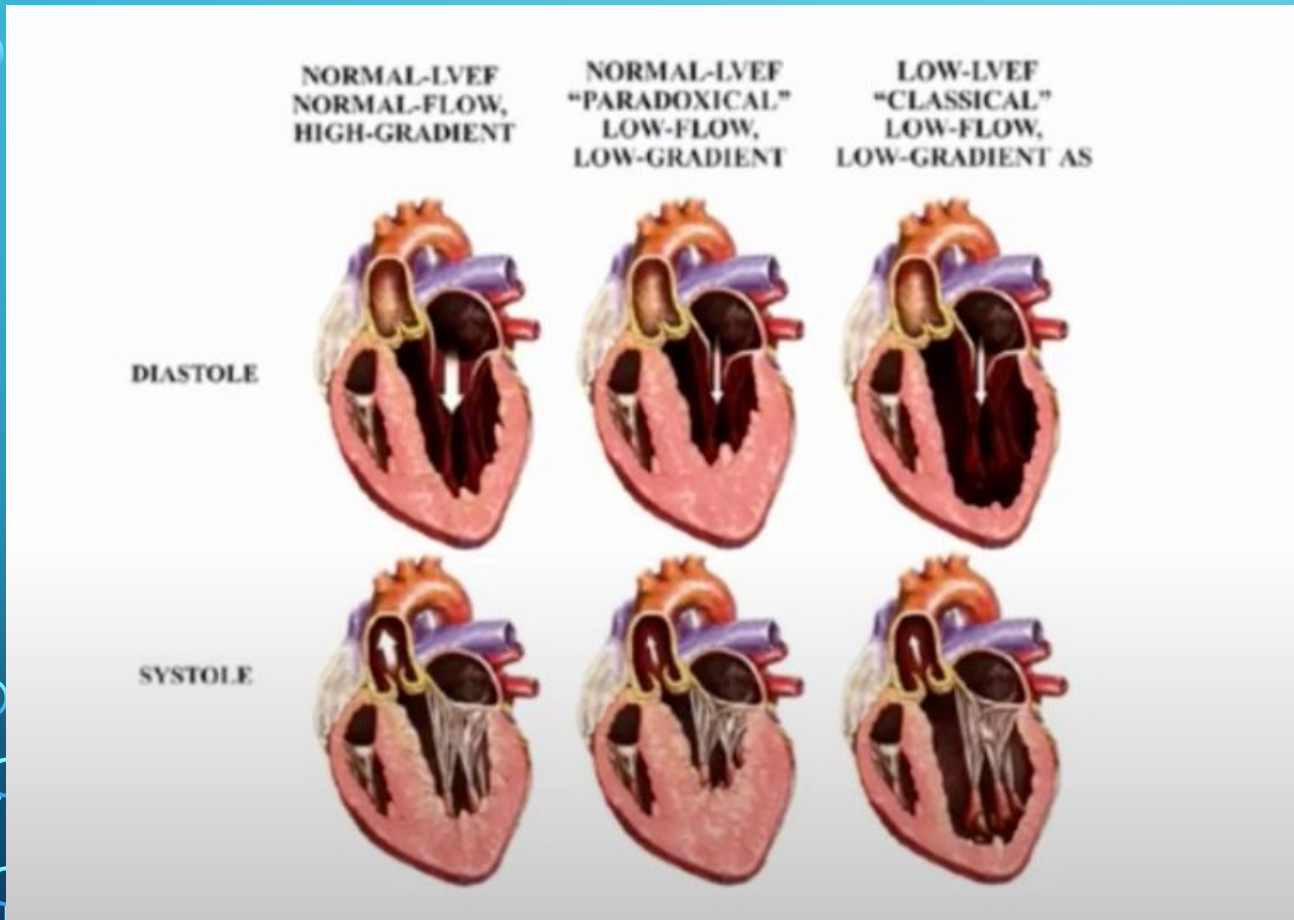
Aortic Stenosis

Natural History



Aortic Stenosis

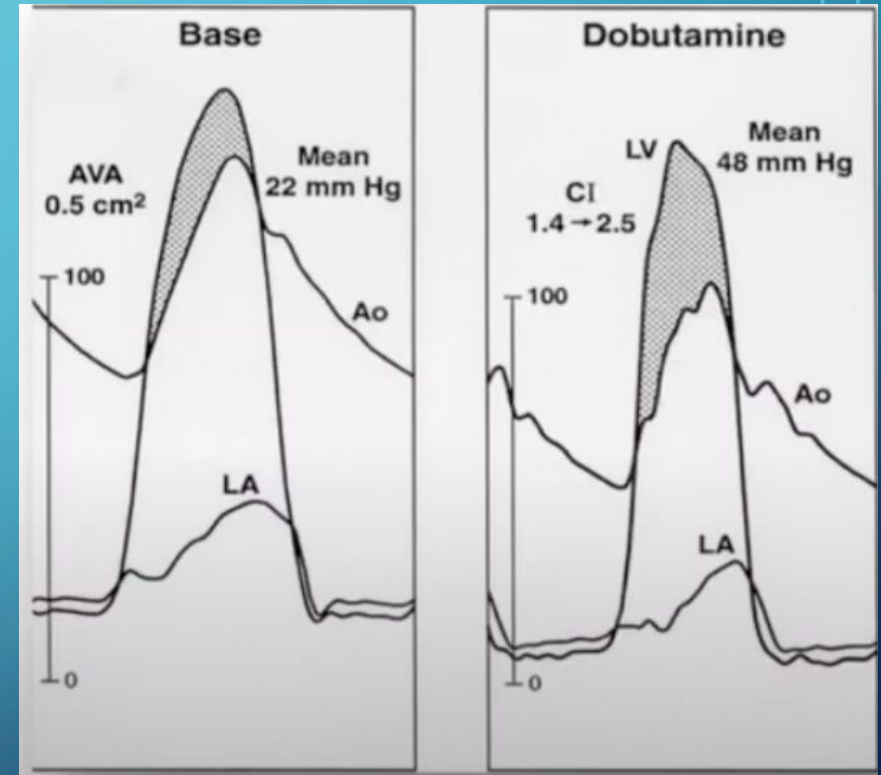
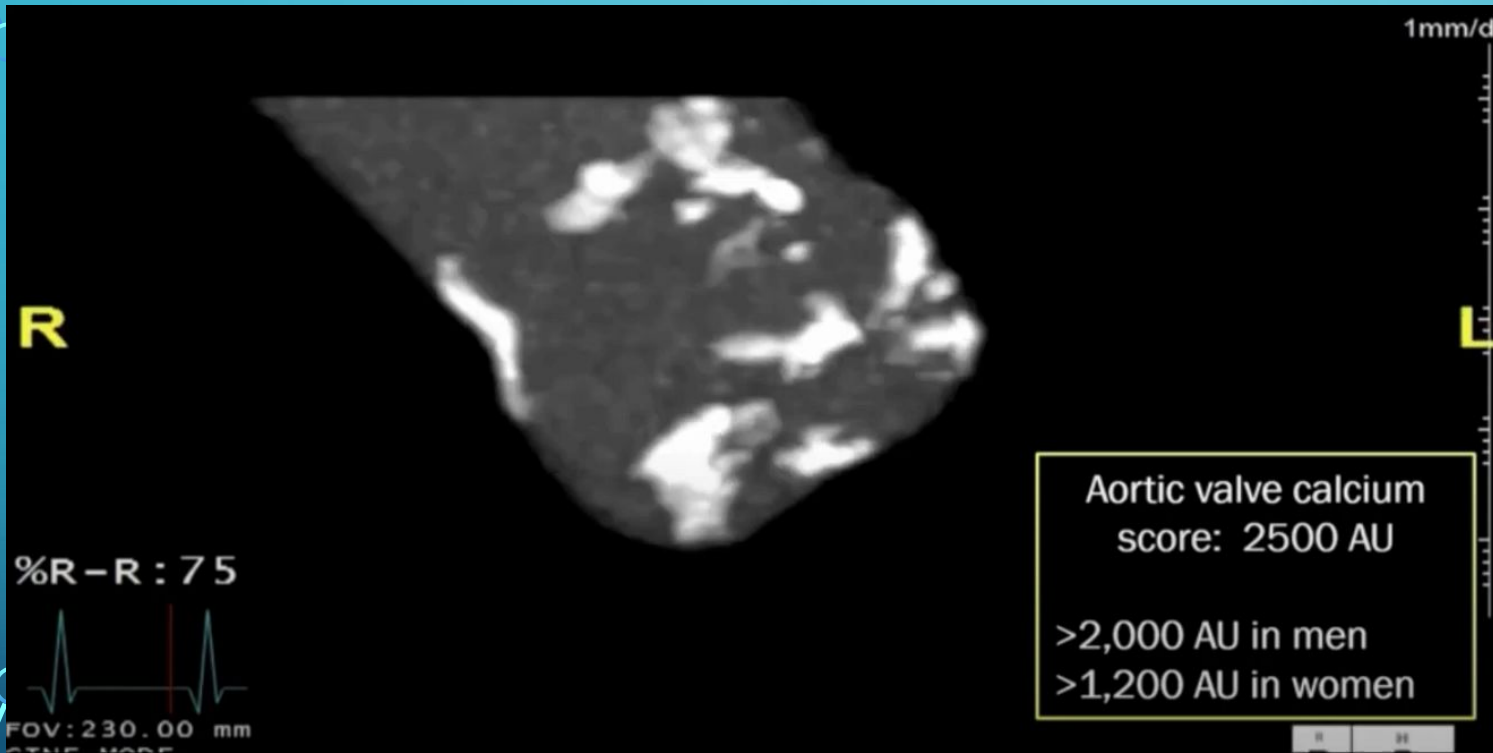
Diagnosis



Exam findings \neq echo findings

→ Further testing

Aortic Stenosis Diagnosis



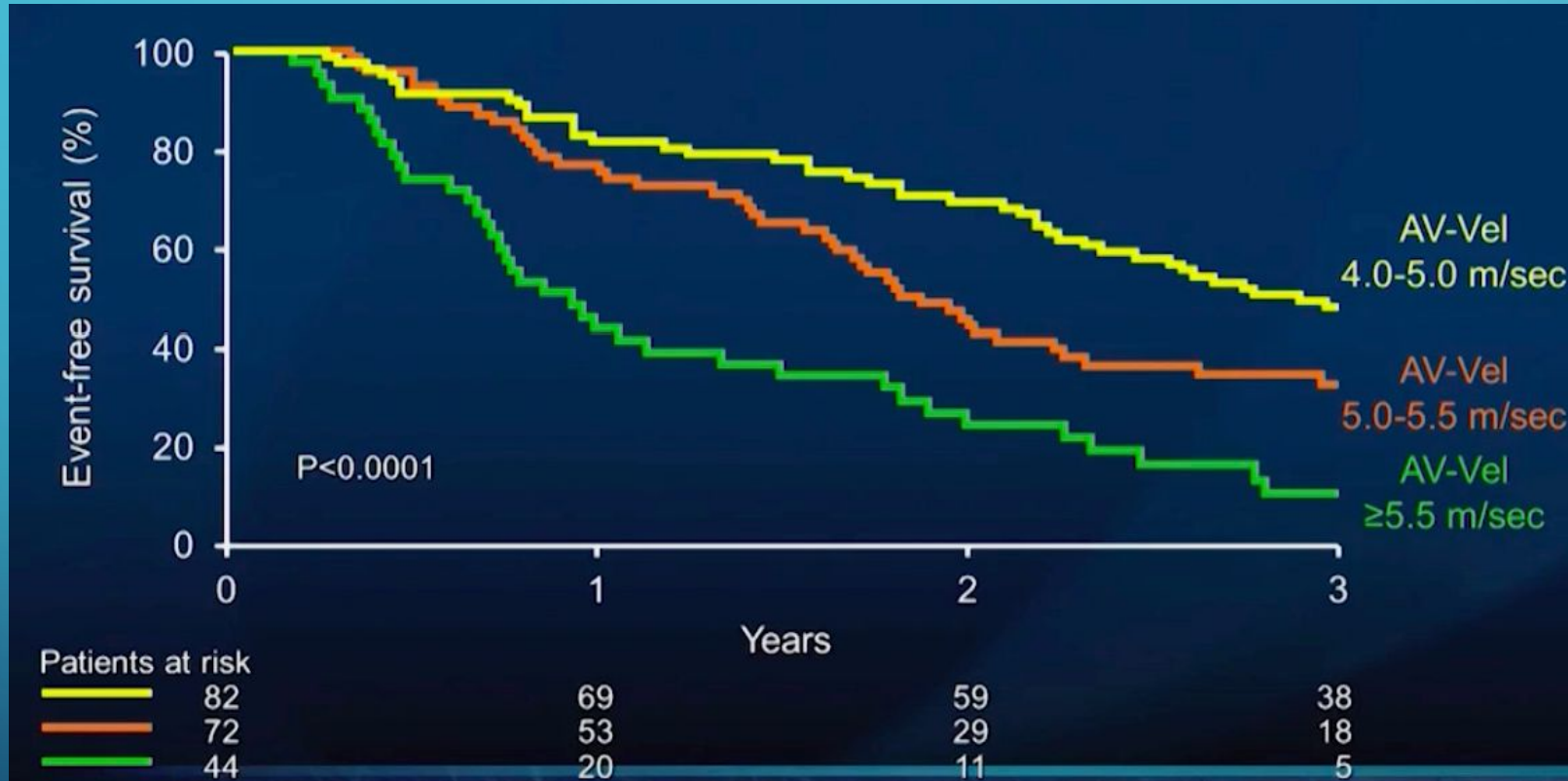
Aortic Stenosis

Treatment: Aortic Valve Replacement

- When to operate?
 - severe AS and
 - Symptoms, irrespective of LV function
 - LV dysfunction
 - Exercise-induced symptoms
 - Moderate-severe AS if planned to undergo other cardiac surgery
 - Asymptomatic **VERY** severe AS.

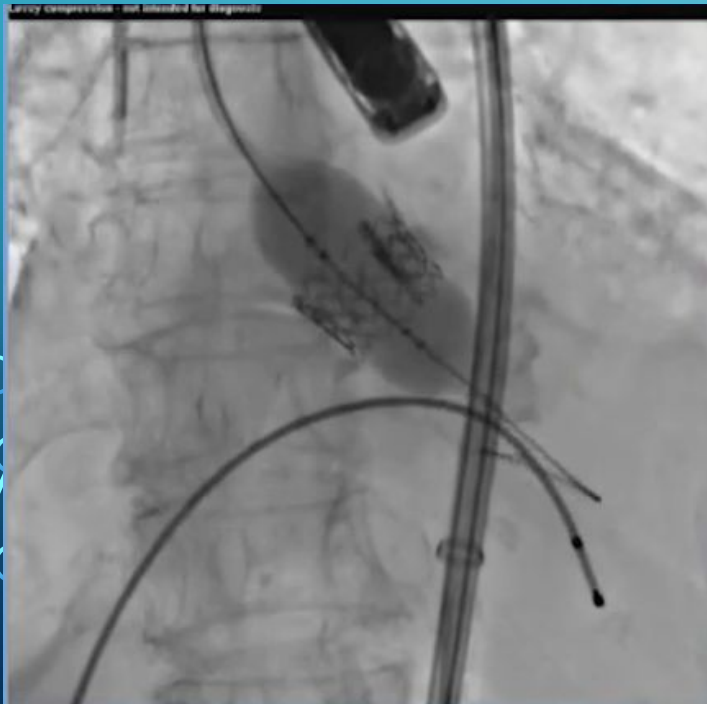


Aortic Stenosis



Aortic Stenosis

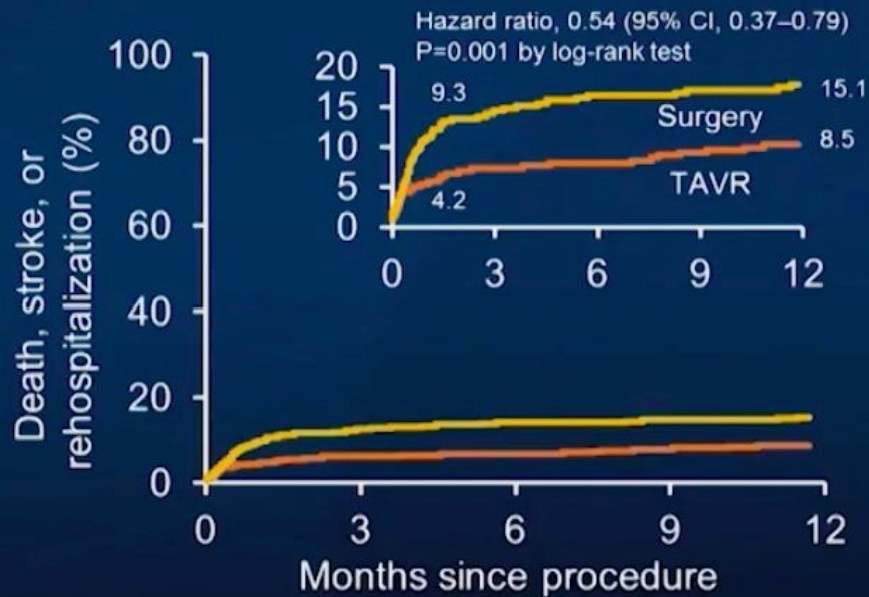
Treatment: Aortic Valve Replacement



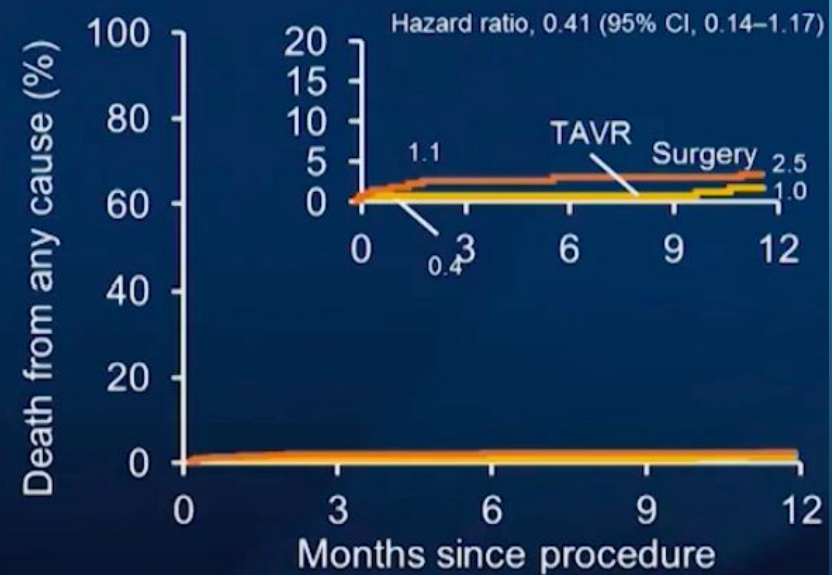
Aortic Stenosis

Treatment: Aortic Valve Replacement

Partner Trial – TAVR vs SAVR in low risk patients



No. at risk	0	3	6	9	12	
— (Surgery)	454	408	390	381	377	374
— (TAVR)	496	475	467	462	456	451

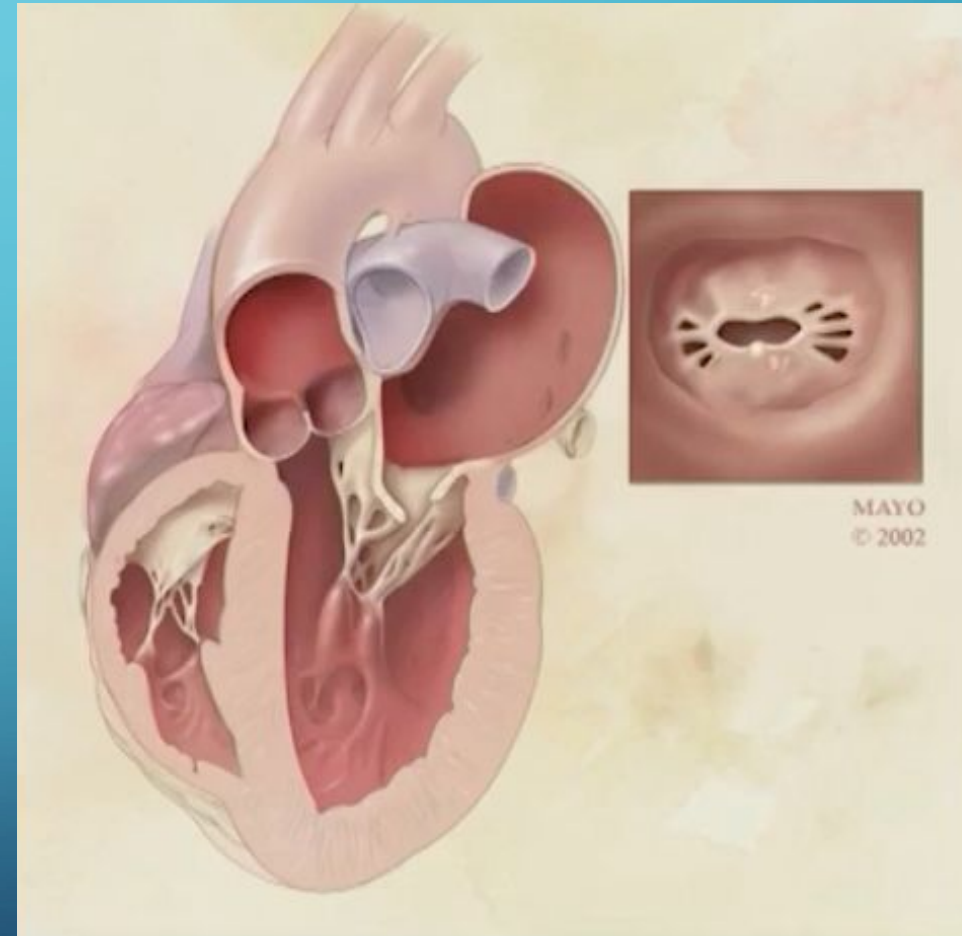


No. at risk	0	3	6	9	12	
— (TAVR)	454	445	438	433	431	427
— (Surgery)	496	494	494	493	492	488

Mitral Stenosis

Etiologies

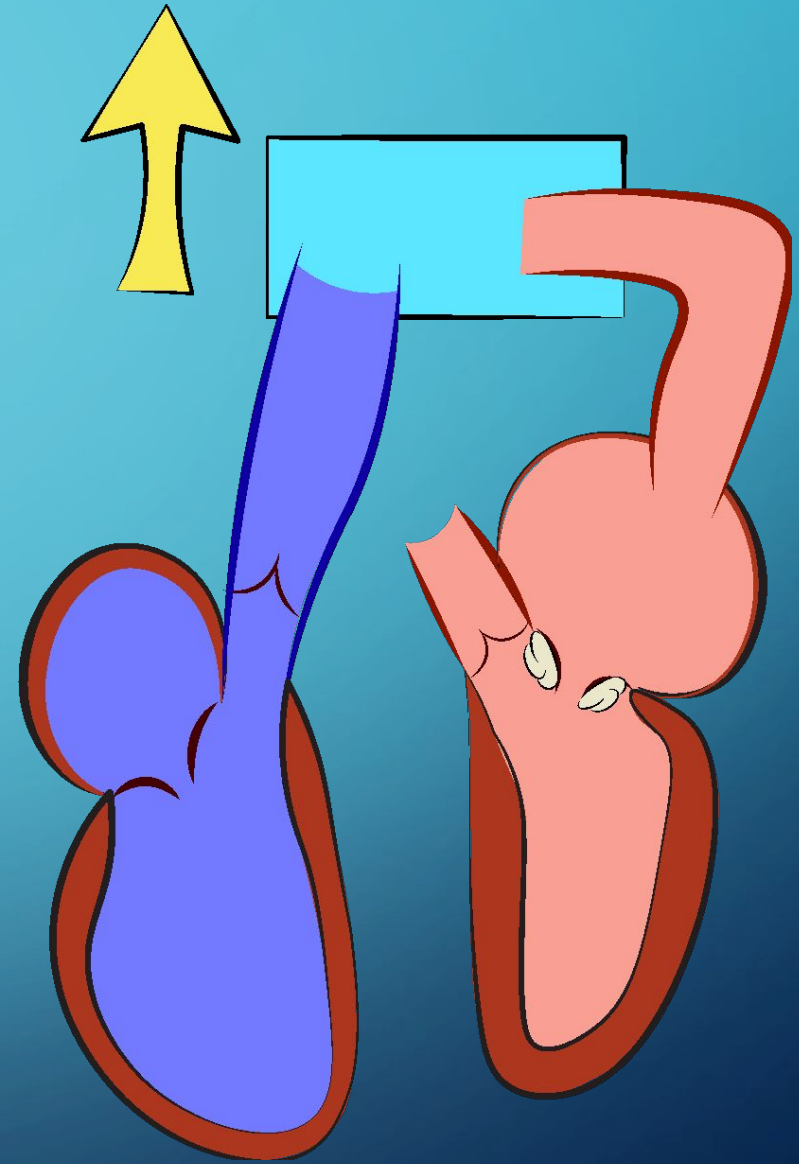
- Rheumatic (most common)
- Degenerative calcification (older age)



Mitral Stenosis

Pathophysiology

- Unaffected LV
- Elevated LA pressure
- Pulmonary Hypertension
- Atrial arrhythmias
- RV failure

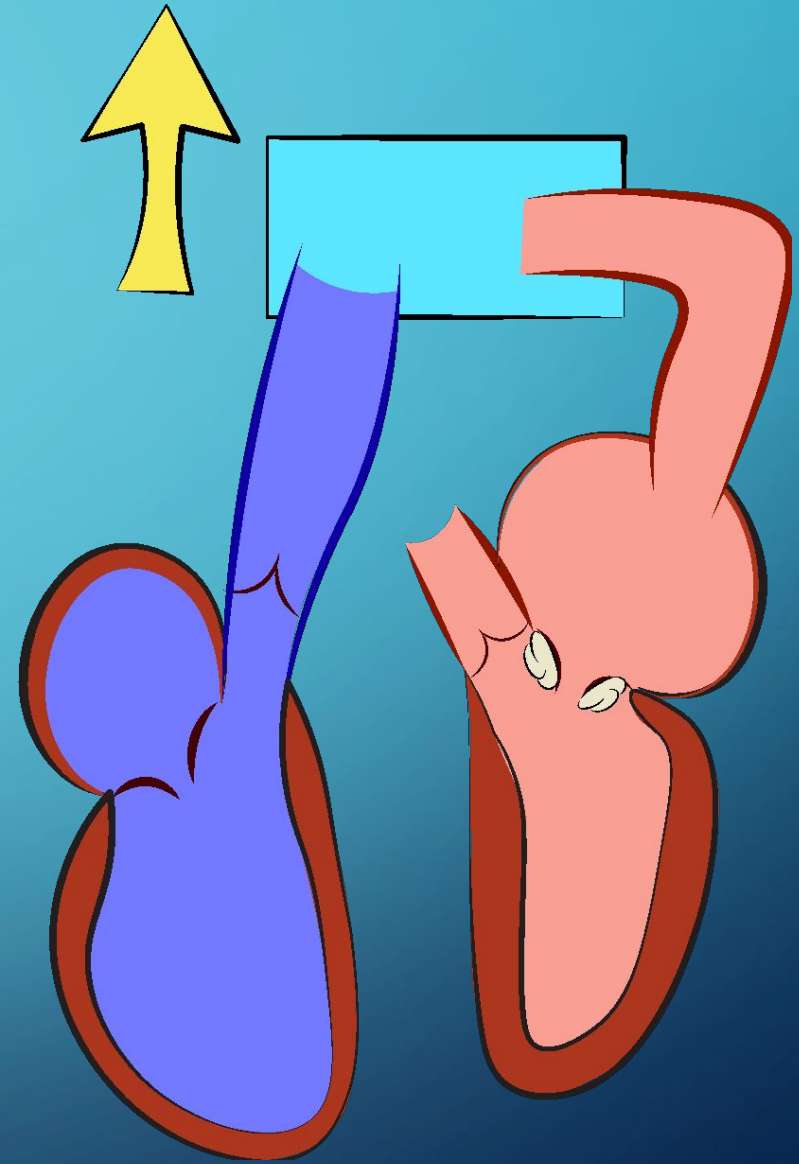


Mitral Stenosis

Symptoms

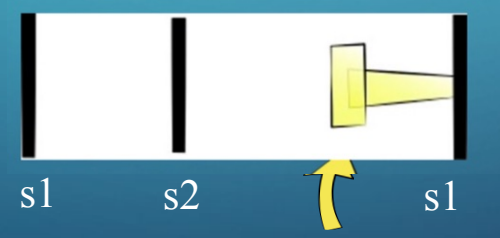
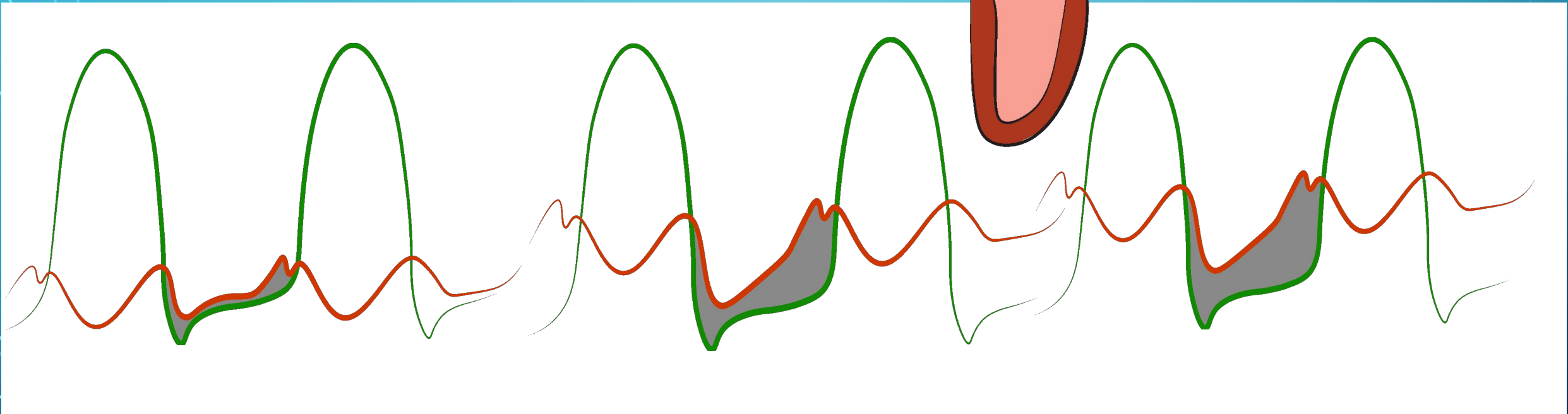
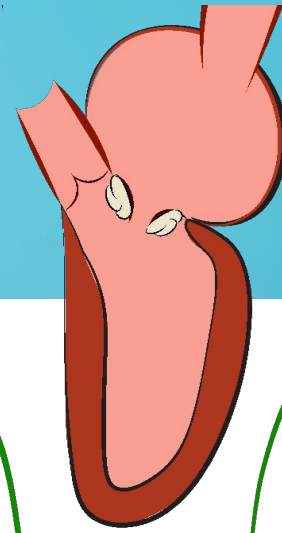
- *Paroxysmal nocturnal dyspnea*
Dyspnea, PND, orthopnea
 - Slow, progressive course
- Hemoptysis
- Palpitations
- Emboli

* Enemy of mitral stenosis is → Tachycardia



Mitral Stenosis

Pathophysiology

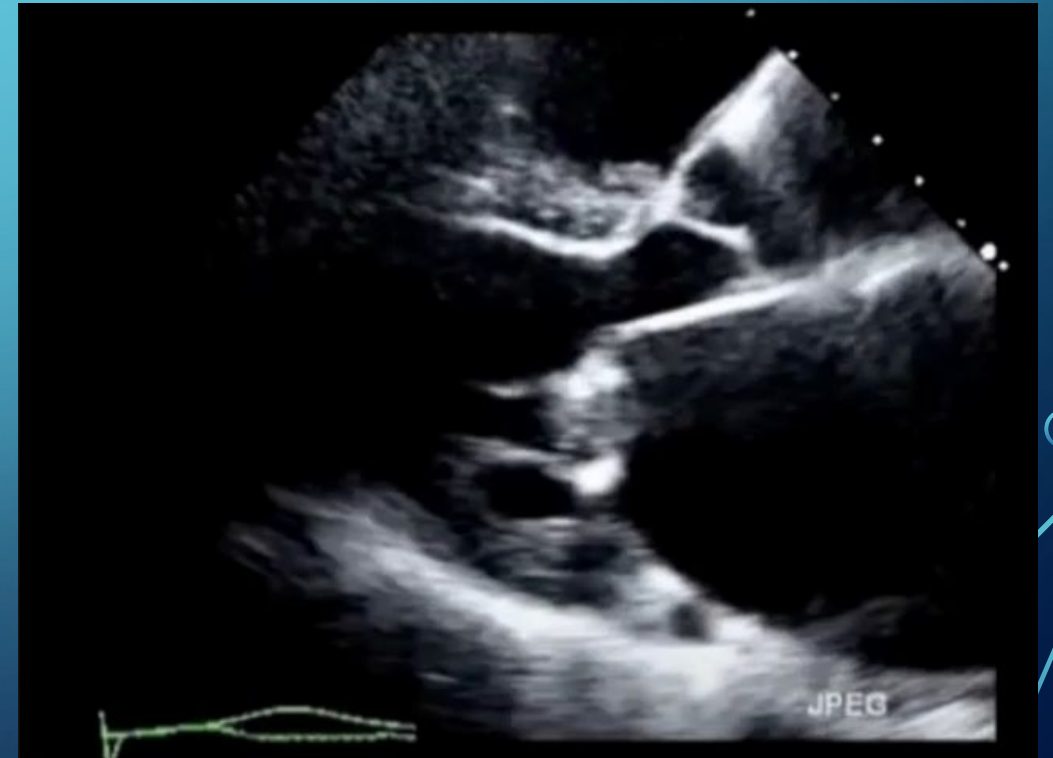
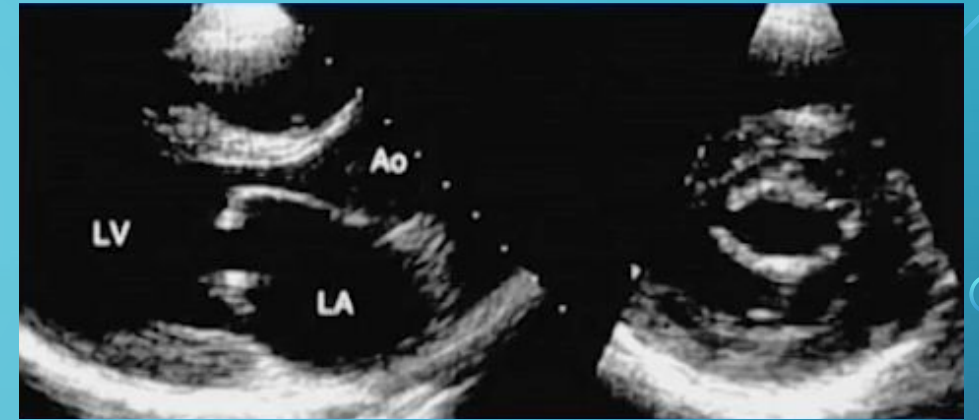
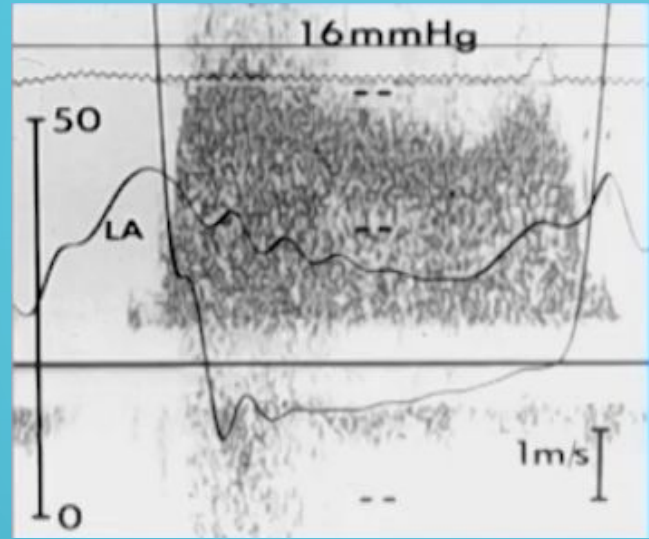


Opening snap + late diastolic murmur



Opening snap + mid-late diastolic murmur

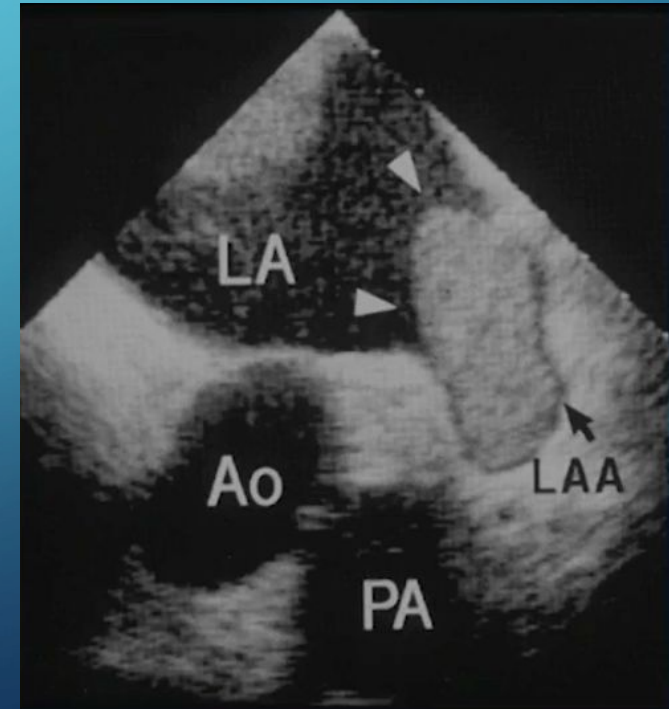
Mitral Stenosis Diagnosis



Mitral Stenosis

Treatment

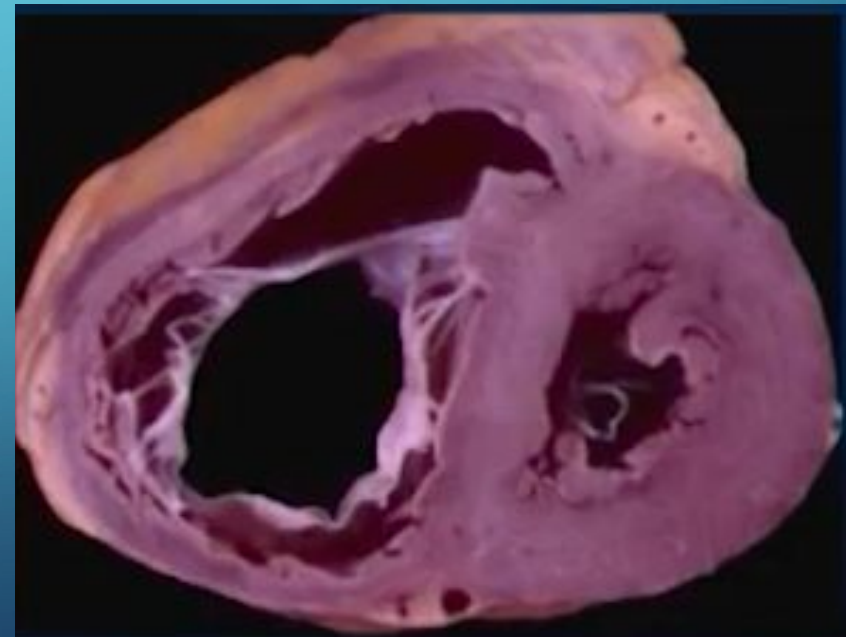
- Indications for intervention:
 - Severe symptoms of heart failure at rest or signs on exercise
 - Mild symptoms if non-surgical management is feasible (percutaneous mitral balloon commissurotomy)
- Anticoagulation if atrial fibrillation



Tricuspid Regurgitation

Etiology

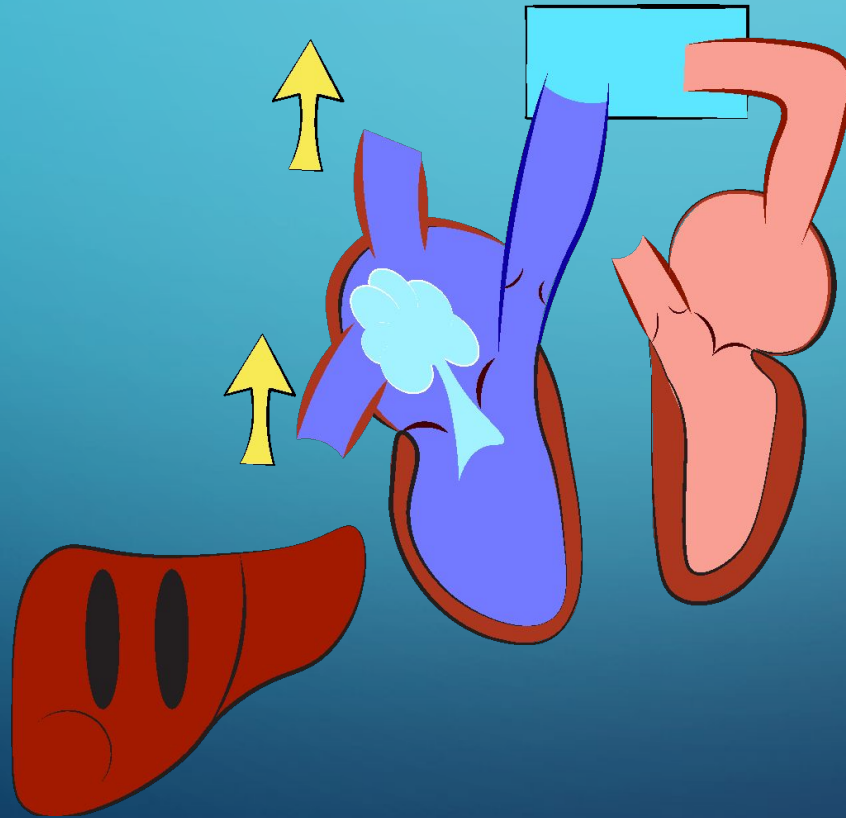
- **Primary Valvular**
 - Rheumatic
 - Congenital
 - Endocarditis
 - Carcinoid tumor
 - Pacemaker Leads
- **Secondary**
 - Dilated cardiomyopathies
 - Pulmonary HTN
 - Atrial fibrillation and annular dilation



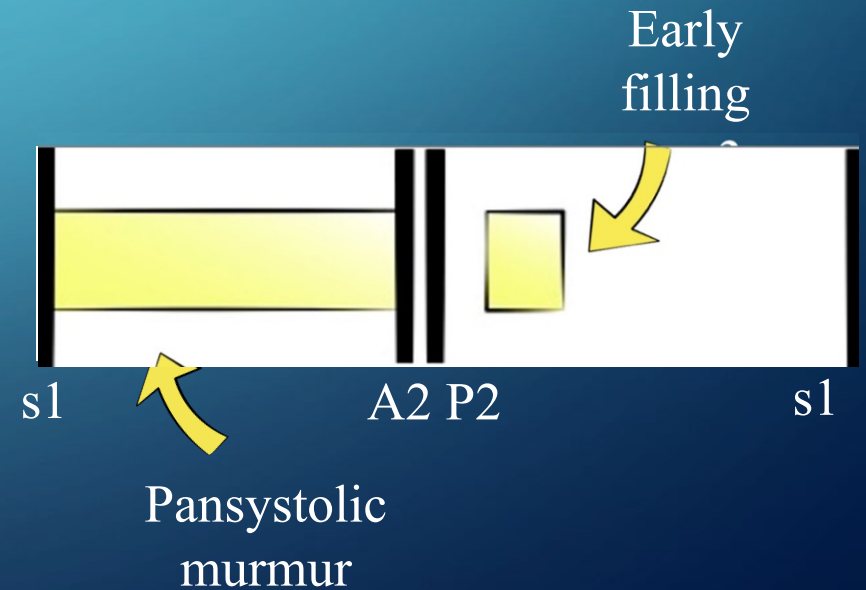
Tricuspid Regurgitation

Clinical Presentation

- History
 - Edema
 - Ascites
 - Fatigue



- Exam
 - Elevated JVP
 - Pulsatile Enlarged Liver
 - Pansystolic murmur
 - ↳ holosystolic



Tricuspid Regurgitation

When to operate?

- Severe symptomatic cases not responding to diuretics
- Severe, if left-sided surgery is planned
- Moderate, if left-sided surgery and RV is enlarged
- If related to a pacemaker lead, attempt lead removal +/- TVR
- If AF, attempt to return to normal sinus rhythm first

The background is a blue gradient with decorative circuit-like patterns in the corners. These patterns consist of thin white lines forming various shapes, including circles and straight lines, resembling a printed circuit board layout. The patterns are located in the top-left, top-right, bottom-left, and bottom-right corners.

Thank You